

REPORT for 2008

**New Brunswick
Air Quality
Monitoring Results**

Environmental Reporting Series

NEW BRUNSWICK
AIR QUALITY MONITORING RESULTS
FOR THE YEAR
2008

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EXECUTIVE SUMMARY

This report summarises air quality monitoring data in New Brunswick for 2008. The report is intended to provide a convenient summary of air quality results for general public information, with emphasis on air quality assessment in relation to existing air quality standards and objectives. Long-term trend data are also presented for representative sites.

Air quality has been monitored in New Brunswick since the 1960s, when several short-term studies were carried out in Saint John. Since that time, the size of the air quality monitoring network has grown as interest in air quality has increased and monitoring technologies have improved. This Report presents summary statistics from 95 instruments at 57 monitoring sites in the province, with additional statistical data (in chart form) in an Appendix. The report also includes results from the acid rain network of 13 sites and monitoring of volatile organic compounds. Details are also provided in the report on the quality assurance procedures used in the provincial air quality system.

The air monitoring networks for the UPM pulp mill and Weyerhaeuser oriented strand board plant in Miramichi are no longer operational as both mills were permanently shut down in 2007.

There were no exceedances of New Brunswick air quality objectives for nitrogen dioxide or carbon monoxide at any of the provincial monitoring sites in 2008. Exceedances of the 1-hour standard for sulphur dioxide were lower in Saint John than in 2007, and very infrequent elsewhere. Also, there were no exceedances of the 1-hour National

Ambient Air Quality Objective for ozone at any site in the province. The number of exceedances of total reduced sulphur (TRS) decreased in Nackawic in 2008, as they did in Saint John. Levels of $PM_{2.5}$ and ozone remained below the Canada-wide Standards, in advance of the 2010 achievement date.

Annual average total volatile organic compounds (VOC) concentration continued to decline at Forest Hills in 2008 as it has since 2005; whereas at Champlain Heights, a decrease in total VOC concentration after 2005 was offset by an increase at that site by about 35% between 2007 and 2008.

An examination of air quality trends at sites with long records indicates that since the late 1970s and 1980s, air quality has improved for all pollutants currently being measured, with the possible exception of ground level ozone, for which no clear trend is apparent. Annual average levels of sulphur dioxide have decreased significantly over the past 15-20 years. The long term levels of carbon monoxide and nitrogen dioxide have also decreased.

Although acid deposition has generally declined since the early 1990s, its effects continue to be of concern in the province, particularly in the south-west, which is the area of the province that is most sensitive to the effects of acid rain. Although sulphate deposition was slightly increased in many areas as compared to 2007 (possibly as a result of larger rainfall amounts) sulphate concentration in precipitation was moderately lower in 2008 compared to 2007. The trend overall is downward since 1989, although this downward trend appears to have moderated in recent years.

Feedback

We are interested in your opinions and feedback on this report. All suggestions will be considered, and if possible, incorporated in future reports. You may contact the State of the Environment Branch at (506) 444-2644, by fax at (506) 453-2265 or by e-mail Randy Piercey at Randy.Piercey@gnb.ca with any comments. The layout and some sections of text contained in this report are courtesy of previous annual reports prepared by Rob Hughes.

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List of Acronyms and Abbreviations

DENV	Department of Environment
ppb	Parts per billion
ppm	Parts per million
$\mu\text{g}/\text{m}^3$	Micrograms per cubic meter
CO	Carbon monoxide
SO ₂	Sulfur dioxide
NO ₂	Nitrogen dioxide
TRS	Total reduced sulfur
NO _x	Nitrogen oxides
TSP	Total suspended particles
VOC	Volatile organic compounds
PM _{2.5}	Fine particulate matter
BAM	Beta attenuation method
TEOM	Tapered element oscillating microbalance
CWS	Canada-wide Standard
NAPS	National Air Pollution Surveillance
PAH	Polycyclic Aromatic Hydrocarbons

1. INTRODUCTION

This report summarises air quality information gathered during 2008 at monitoring locations across New Brunswick. A summary of data from the provincial acid precipitation monitoring network is also included. The report focuses on ambient (i.e. outdoor) air, which provides an indication of environmental quality in terms of air pollution.

Air quality objectives used in New Brunswick are listed on page three of this report. Additional information on air quality standards and objectives, sources and effects of air pollutants, climate change and air quality may be found on the Department of the Environment (DENV) web site at:

<http://www.gnb.ca/0009/0010-e.asp>

2. MONITORING NETWORKS

Compliance with air quality objectives or regulatory standards is determined by monitoring, for the most part on a continuous basis.

Monitoring locations are selected so that they will provide information that is representative of the surrounding area. In cases where there is a known pollutant source, monitors are often distributed in locations where the impact is expected to be greatest. Such locations are typically selected based on the results of computer dispersion models. These are computer programs which simulate the behaviour of plumes, or discharge streams of gases as they are released from smokestacks. Such models take into account the complete variety of weather conditions which may be experienced in the area where the stack is located, as well as the nature of the local landscape.

In New Brunswick, large industrial emission sources, such as electricity generating stations or pulp mills, are legally required by the DENV to carry out ambient air quality monitoring as prescribed in their Approvals to Operate under the Clean Air Act. Such Approval conditions also detail the required equipment specifications, locations and reporting frequency. In such cases, the monitoring equipment and maintenance procedures are checked periodically by DENV staff or independent auditors, to ensure the required standards for operation and technical accuracy are being met.

In the case of air pollutants which are transported long distances, and which may be found in rural, as well as urban areas, DENV establishes and operates its own monitoring sites. The Department also maintains sites in areas where there are multiple large industrial emission sources, such as greater Saint John.

Additionally, there are 13 provincial acid precipitation monitoring sites augmented by one federally-operated site in New Brunswick (at Harcourt, in eastern New Brunswick).

Federal support is also provided for the operation of several other air quality monitoring sites across the province (through the National Air Pollution Surveillance (NAPS) program).

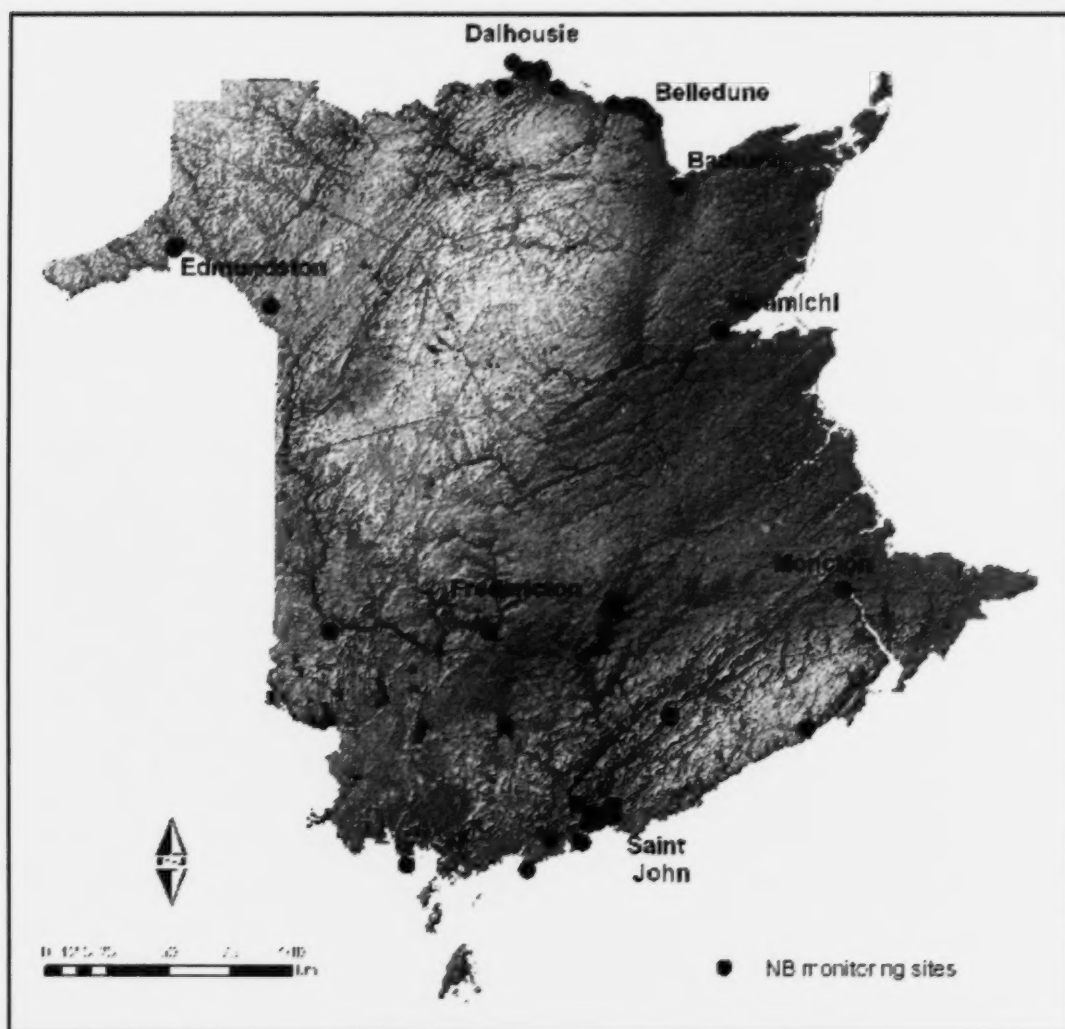


Figure 1. Locations of air quality monitoring sites in New Brunswick, 2008.

The following table lists the New Brunswick Air Quality Objectives for five air pollutants: carbon monoxide (CO), hydrogen sulphide (H_2S), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and total

suspended particulate (TSP). These Objectives are established under the Clean Air Act that includes a provision for required annual reporting to the Legislative Assembly on achievement of air quality objectives.

New Brunswick Air Quality Objectives				
Pollutant	Averaging period			
	1 hour	8 hour	24 hour	1 year
Carbon monoxide	30 ppm	13 ppm		
Hydrogen Sulphide	11 ppb		3.5 ppb	
Nitrogen dioxide	210 ppb		105 ppb	52 ppb
Sulphur dioxide*	339 ppb		113 ppb	23 ppb
Total suspended particulate			120 µg/m ³	70 µg/m ³

* The standards for sulfur dioxide are 50% lower in Saint John, Charlotte, and Kings counties.

As there is no New Brunswick Air Quality Objective for ozone (O₃), the National Objectives for ozone are included below.

Elsewhere in the report, reference is made to other air quality standards or objectives from other jurisdictions (provincial, national or international) to aid in the interpretation of air quality conditions in New Brunswick.

Determining compliance with the Canada-wide Standard (CWS) for PM_{2.5} (fine particulate) of 30 µg/m³ (not required before 2010) is a complex calculation derived from the 98th percentile of daily averages in each year, averaged over three consecutive years. In the absence of another benchmark for PM_{2.5}, and for purposes of this report, PM_{2.5} values are compared to the CWS level of 30 µg/m³.

National Ambient Air Quality Objectives for Ozone (ppb)			
Averaging period	Desirable Level	Acceptable Level	Tolerable Level
1 Hour	51	82	153
24 hours	15	25	-
Annual	-	15	-

3. AIR QUALITY MONITORING RESULTS FOR 2008

Results are presented for each monitoring network in the Province. The locations of the monitoring sites are shown on regional scale maps. The numeric results are shown in tables, and further details in chart form appear in Appendix 1. Explanatory notes are provided on each network, and a discussion of the results for each network is included.

A. SAINT JOHN

The greater Saint John area has the longest history of air quality monitoring in New Brunswick, beginning in 1961. Since that time, air quality has been monitored at more than 30 different locations in the city and surrounding area. A total of 16 air quality monitoring sites, which were active in 2008, are shown in Figures 2 and 3. Figure 3 shows four sites established in connection with the Coleson Cove generating station.

Most of these sites are electronically linked to a central computer at the DENV central office in Fredericton. The system communicates with the monitors a minimum of once each hour and obtains the latest readings. The readings are then added to the existing data archive and some are used to prepare IQUA (Index of the Quality of the Air) public information messages, as well as to determine the nature of any abatement actions required by industries if concentrations rise above pre-determined trigger values. Such episode control systems are specified in various Approvals to Operate issued to major emission sources by the Department.

On the City's west side, three monitoring sites for total reduced sulphur (TRS) are operated by Irving Pulp and Paper Ltd. DENV also operates a site at the Hillcrest Baptist Church off Lancaster Avenue, at which SO_2 , TRS, O_3 , $\text{PM}_{2.5}$ and NO_2 (added in January 2008) are monitored. In east Saint John, four sites for SO_2 , one for $\text{PM}_{2.5}$, one for NO_2 and one for TRS are operated by Irving Oil Ltd., as required by the company's operating approval, and results are sent electronically to the Department's data system.

To the west, outside the city, NB Power maintains sites at Grand Bay-Westfield (SO_2), Musquash (SO_2), Manawagonish Road (SO_2 and $\text{PM}_{2.5}$) and Lorneville (SO_2 and $\text{PM}_{2.5}$).

DENV also maintains sites at Forest Hills and Champlain Heights in east Saint John, and at the Customs Building and Castle Street in the uptown area. At Forest Hills, there are monitors for O_3 , SO_2 , NO_2 , $\text{PM}_{2.5}$, TRS, volatile organic compounds (VOCs) and others (aldehydes and Polycyclic Aromatic Hydrocarbons (PAHs)). At the Champlain Heights School, SO_2 , TRS, NO_2 , VOCs, $\text{PM}_{2.5}$ and aldehydes are measured. The Customs site has monitors for O_3 , SO_2 , NO_2 and CO. $\text{PM}_{2.5}$ is measured at the DENV Saint John office on Castle Street.

A.1 Carbon Monoxide

This pollutant is monitored at the Customs Building site to provide data representative of the Saint John centre. Peak hourly values in every month seldom exceeded 1.0 ppm, and thus were well below the applicable objective of 30 ppm. In addition, there were no exceedances of the 8-hour objective of 13 ppm.

A.2 Nitrogen Dioxide

There were no exceedances of the 1-hour objective of 210 ppb at any sites (Forest Hills, Customs Building, Champlain Heights School or Grandview West 2) during 2008. Neither were the 24-hour objective (105 ppb) or the annual objective (52 ppb) exceeded.

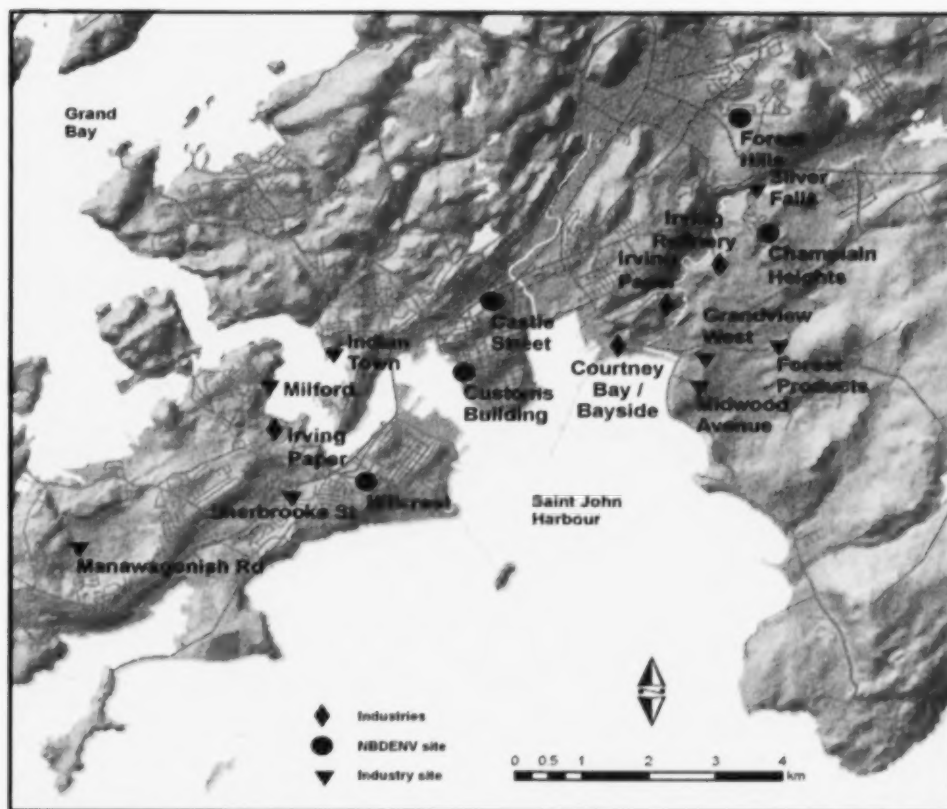


Figure 2. Air quality monitoring sites in Saint John, New Brunswick, 2008.

A.3 Sulphur Dioxide

There was only one exceedance of the 1-hour objective for SO_2 at the Forest Hills site on July 30, 2008. The level reached 329 ppb when winds were blowing from the south at approximately 10 km/hr. $\text{PM}_{2.5}$ levels were also relatively high at this time, when the average value reached $50 \mu\text{g}/\text{m}^3$ for 1 hour.

At the Grandview West site there were a similar number of exceedances of the 1-hour objective for sulphur dioxide in 2008 as in 2007 (10 versus 11). These exceedances occurred during five

separate events throughout the year. The number of exceedances of the 24-hour objective increased from 11 in 2007 to 68 in 2008, representing four separate events. However, all of the exceedances of the 24-hour objective occurred prior to the commissioning of the new Hydrogenation Amine Tail Gas Unit (HATGU) at the Irving refinery, which took place in April 2008.

In the Coleson Cove Network, there were no exceedances of SO_2 .

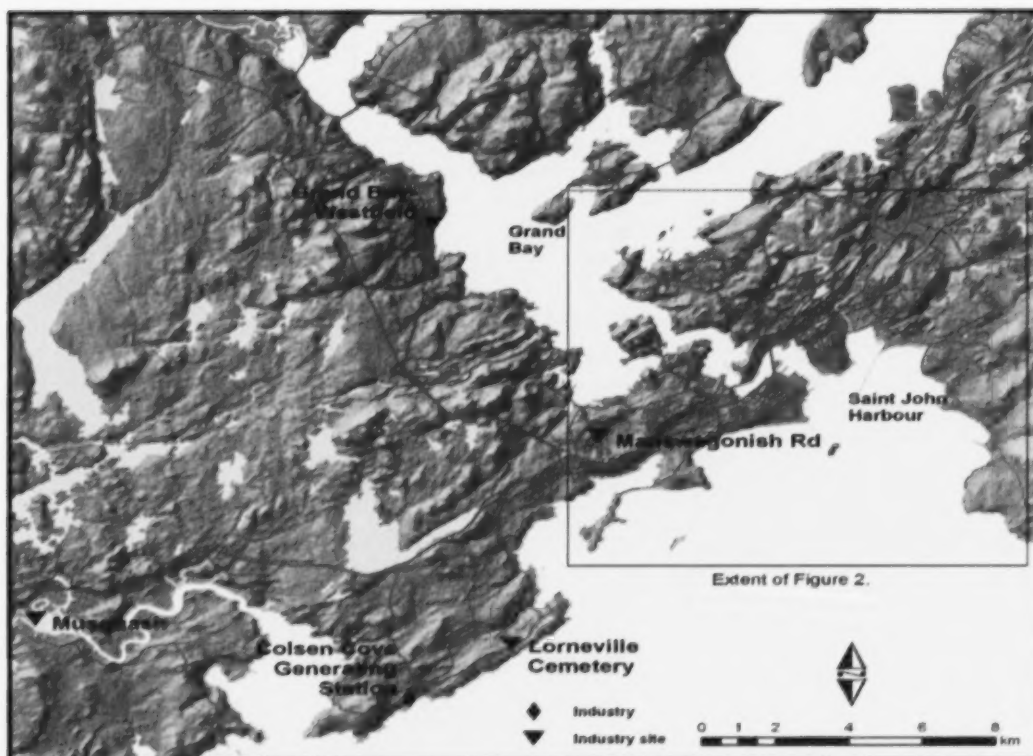


Figure 3. Locations of NB Power Colson Cove network air quality monitoring sites in New Brunswick, 2008.

A.3.1 Sulphur Dioxide Episode Control

An episode control program is in place to prevent ambient SO_2 reaching undesirably high levels in Saint John. Control actions are initiated by major industries in the city in response to measurements made at the fixed monitoring sites.

These control actions are made mandatory by being incorporated into the relevant Approvals to Operate issued by DENV. The episode control plans themselves are subject to continual review. DENV meets regularly with staff of the major industries in the city to review compliance with respect to SO_2 .

All exceedance events are examined in detail and any shortfalls in the nature and extent of response action are addressed. DENV staff sometimes

request emission control actions separate from, or in addition to, those specified in the episode control plans. Such action may be warranted due to unusual conditions, such as poor dispersion, or during periods when smog advisories are in effect.

Some of the ways in which industries respond to rising levels of SO_2 include switching to lower or near-zero sulphur fuels, and reducing production rates or electricity generating rate. Response action is initiated when concentrations reach 80 ppb, approximately half the 1-hour objective of 170 ppb.

Table 1. Exceedances of provincial objectives for SO₂, Saint John, 1999-2008.

	Midwood Avenue	Champlain Hts	Customs Building	Forest Hills	Forest Products	Hillcrest	Grandview West 1	Silver Falls
1 HOUR OBJECTIVE								
2008	0	0	0	1	0	0	10	0
2007	0	0	0	5	0	0	11	0
2006	2	1	0	0	0	0	61	0
2005	0	3	0	1	0	0	135	4
2004		0	2	0	0	0	153	2
2003		1	0	1	2	0	153	10
2002		0	0	0	0	0		0
2001		1	0	0	0	0		4
2000		4	3	1	1	2		3
1999		0	0	2	4	0		0
24-HOUR OBJECTIVE								
2008	0	0	0	0	0	0	68	0
2007	0	0	0	35	0	0	13	0
2006	19	0	0	0	0	0	255	0
2005	0	0	0	0	0	0	331	16
2004		0	0	0	0	0	504	31
2003		47	0	23	3	0	429	117
2002		0	0	0	0	23		14
2001		4	0	0	0	0		47
2000		35	0	0	0	0		0
1999		0	0	25	25	0		0

A.4 Particulate Matter

PM_{2.5} is measured at six sites in the Saint John area using BAM monitoring technology. Three of these sites are maintained by DENV, one by Irving Oil Ltd., and two are maintained by NB Power as part of their Coleson Cove monitoring network. Results are summarized in Table 2.

In 2008 the annual average value for PM_{2.5} ranged from 4.9 µg/m³ to 8.0 µg/m³ at these sites. The Manawagonish Road site had the greatest 24-hour average 98th percentile value at 20.9 µg/m³. On May 1, 2008 the daily average PM_{2.5} value exceeded 30 µg/m³ at the Hillcrest moni-

toring site, the only time this occurred at any of the sites in Saint John. The recorded value was 42.0 µg/m³ and no other PM_{2.5} monitors recorded elevated values at the time. The high PM was traced to the Irving Pulp and Paper Mill where one of two precipitators (controlling emissions of PM) had temporarily failed.

Table 2. Monitoring results for PM_{2.5}, Saint John Network, 2008.

	Forest Hills	Hillcrest	Champlain Hts	Castle St.	Lorneville*	Manawagonish Rd.*
Annual average (µg/m ³)	6.0	4.9	7.0	6.7	6.1	8.0
98 th percentile value (CWS)	19.0	13.2	13.5	17.6	16.9	20.9
Days with daily average >30 µg/m ³	0	1	0	0	0	0
Hours with running 24-hour average >30 µg/m ³	0	23	0	0	0	0

* Coleson Cove Network

A.5 Ground Level Ozone

O₃ was monitored at three sites in the city during 2008: Forest Hills, Customs Building and in West Saint John at Hillcrest Church. Results are summarized in Table 3. During 2008, there were no exceedances of the 1-hour National Ambient Air Quality Objective for O₃ of 82 ppb in the Saint John Network. Statistics were also calculated in reference to the Canada-wide Standard for

O₃, which is based on a maximum daily 8-hour average, and is set at 65 ppb. No exceedances of this level were recorded in 2008.

Further details on ground level O₃ follow in section 8, where additional results for all O₃ monitoring sites are summarised.

Table 3. Monitoring results for Ozone, Saint John Network, 2008.

	Forest Hills	Hillcrest	Customs Building
Annual average (ppb)	28.0	26.7	25.2
4 th highest daily maximum 8-hour average (CWS)	50.9	50.4	49.8
Days with daily maximum 8-hour average > 65 ppb	0	0	0

A.6 Total Reduced Sulphur

TRS is monitored at Champlain Heights, Hillcrest and Forest Hills by DENV, as well as three sites operated by Irving Pulp and Paper (Milford, Indian Town and Sherbrooke St.) and one site by Irving Oil at Midwood Avenue.

Note: for evaluation of TRS data, and in the absence of a specific objective for TRS, reference is made to the provincial objectives for hydrogen sulphide.

In 2008, there were fewer exceedances of TRS recorded at several sites in east and west Saint John than have occurred in recent years. Exceedance occurrence since 1999 are summarized in Table 4 and further information on TRS levels in 2008 can be found in Appendix 1.

Table 4. Exceedances of provincial objectives for TRS (as H₂S) in Saint John, 1999-2008.

		Forest Hills	Champlain Hts	Midwood Avenue	Hillcrest	Indian Town	Milford	Sherbrooke St.
2008	1-hour	0	1	0	0	1	1	0
2007	1-hour	7	2	0*	0	3	2**	0**
2006	1-hour		7		M	0	0	0
2005	1-hour		2		0	0	3	0
2004	1-hour		3		M	0	0	0
2003	1-hour		0		0	0	0	1
2002	1-hour				0	2	0	0
2001	1-hour				0	0	1	9
2000	1-hour				3	2	0	4
1999	1-hour				1	6	0	0
2008	24-hour	0	0	0	0	0	0	0
2007	24-hour	33	14	0*	0	0	0**	0**
2006	24-hour		21		0	0	0	0
2005	24-hour		0		0	0	22	0
2004	24-hour		0		M	0	19	0
2003	24-hour		0		0	0	0	0
2002	24-hour				0	11	0	0
2001	24-hour				0	0	5	684
2000	24-hour				18	47	12	29
1999	24-hour				20	26	0	0

M = missing data

* Monitoring began in October

** Not monitoring from January-April

A.7 Volatile Organic Compounds (VOCs)

VOCs have been measured at Forest Hills in east Saint John since 1992. Measurements have also been made for the same period of time at Point Lepreau, approximately 40 km southwest of the city. The Lepreau site is predominantly upwind of Saint John and serves as a control or reference site, representative of rural southern New Brunswick. In July 2000, VOC sampling was begun at Champlain Heights in east Saint John. The monitoring program for VOCs is a collaborative one between DENV and Environment Canada. DENV staff maintain the monitoring sites and set up the equipment to take samples (normally every 6 days). Environment Canada performs the analyses on the collected air samples.

Sites in Saint John collect one 24-hour sample every 6 days and the rural site at Point Lepreau collects a 4-hour sample beginning at noon, every 3 days. All samples are analysed for over 150 compounds, which include VOCs which are involved in the formation of O_3 , as well as VOCs which may be of interest for other reasons. For example, they may be indicators of various kinds of industrial activity, or they may be potentially of concern in their own right (for example, substances which are known to be carcinogenic, such as benzene). Some other VOCs which are measured are found at similar concentrations regionally or even globally (such as several CFC compounds). These substances are of key interest in atmospheric research.

There are no national ambient air quality standards for VOCs in Canada. Results can be compared against guidelines published by other agencies, and examined over time to look for trends, as well as differences between sites.

Table 5 lists results for 2008 for selected VOCs, compared with guidelines recommended by various agencies. This subset of VOCs contains compounds which have traditionally been classified as "air toxics", and which are considered potentially harmful to human health. The first line of the results table also shows the average concentration taking into account all VOCs measured at each site (total VOC).

Levels of VOCs measured at Champlain Heights are typically higher than at Forest Hills, and this was true for 2008. Both sites had higher concentrations of most VOCs than the Point Lepreau site.

For the selected VOCs for which guidelines could be referenced, concentrations at both monitoring sites were found to be below these targets, in most cases by a substantial margin. The annual guideline for benzene published in the United Kingdom (5 ppb) has a long-term target of 1 ppb (EPAQS, 1994; HMSO, 2000). The Swedish guideline is 1.5 ppb with a compliance date of 2010 (Swedish EPA, 2003). Benzene is emitted from motor vehicles and is a component of gasoline. In Saint John, the petroleum refinery and other industries would also contribute to ambient concentrations. Additional analysis of VOC data is included in section 8.

Table 5. Monitoring results for Volatile Organic Compounds, 2008.

VOC	Max 24-hour averages (ppb)		24-hour guidelines (ppb)	Annual averages (ppb)			Annual Guidelines (ppb)
	Forest Hills	Champlain Hts		Forest Hills	Champlain Hts	#Point Lepreau	
Total VOC	104.80	314.68		27.42	76.80	5.69	
1,3 butadiene	0.09	0.43		0.02	0.03	0.00	1 (UK)
Benzene	0.69	2.34		0.20	0.63	0.07	1.5 (UK, Sweden)
Toluene	2.48	9.94	63* (WHO) 106 (AB) 24 (ON)	0.35	1.52	0.06	10-100 (Sweden)
Ethylbenzene	0.25	1.12	4464* (WHO) 227 (ON)	0.05	0.26	0.01	
Xylenes	0.75	3.51	1013 (WHO) 161 (AB) 522 (ON)	0.13	0.76	0.02	
Styrene	0.19	0.54	56* (WHO) 94 (MB) 93 (ON)	0.01	0.06	0.02	
Chloromethane	0.70	0.62	3344 (ON)	0.57	0.56	0.54	
Vinyl chloride	0.00	0.00	0.4 (ON)	0.00	0.00	0.00	
1,1 dichloroethylene	0.00	0.00		0.00	0.00	—	
Dichloromethane	0.08	0.23	792 (WHO) 62 (ON)	0.06	0.07	0.09	100-250 (Sweden)
1,2 dichloroethane	0.03	0.61	159 (WHO)	0.01	0.03	0.01	100-150 (Sweden)
Carbon tetrachloride	0.10	0.12	0.4 (ON)	0.09	0.09	0.09	
1,2 dichloropropane	0.01	0.01		0.00	0.00	—	
Trichloroethylene	0.01	0.01	21 (ON)	0.00	0.00	0.00	100-200 (Sweden)
1,1,2 trichloroethane	0.00	0.00		0.00	0.00	0.00	
Ethylene dibromide	0.00	0.00	0.4 (ON)	0.00	0.00	—	
Tetrachloroethylene	0.05	0.02	34 (WHO)	0.01	0.01	0.00	
1,1,2,2 tetrachloroethane	0.00	0.01		0.00	0.00	—	
Formaldehyde	2.14	7.86	52 (ON)	0.73	3.82	—	
Acetaldehyde	1.75	4.97	274 (ON)	0.46	1.44	—	
MTBE	0.01	0.12		0.01	0.00	—	

Notes: The guidelines marked with an asterisk (*) are for a weekly period. AB = Alberta; ON = Ontario; MB = Manitoba. Sources: WHO (World Health Organisation): 1987, 1994, 1996 & 1997; Swedish standards: OECD, 1995; Swedish EPA, 2003. UK standards: HMSO, 2000. Alberta, Ontario, and Manitoba: Provincial Environment Departments. # Data at Pt Lepreau are collected for 4 hour samples, sampling every third day, starting at noon AST. The other sites are based on 24-hour samples every 6th day. For additional information, see also Table 23 on page 48.

A.8 Index of the Quality of the Air (IQUA)

The IQUA system has been used in Saint John for over 25 years to help make air quality monitoring results easier to understand. Results for each pollutant measurement are expressed on a scale from 1-100+, and classed as "good" (index 0 to 25), "fair" (26 to 50), "poor" (51 to 100) or "very poor" (over 100). Each of the categories is based on the National Air Quality Objectives. IQUA information is available via the DENV web site:

<http://www1.gnb.ca/0355/0003/0000.asp>

For each hour, the IQUA index is computed for each pollutant measured at the site. The value reported is the highest of each of the individual values. For example, if two pollutants are in the "good" range and one is in the "poor" range, then the index for the hour would be reported as "poor". In addition, the pollutant responsible for determining the overall index value is usually identified.

Summary statistics are given in Table 6 for the three designated IQUA sites in Saint John: Customs Building (uptown), Forest Hills (east) and Westside Station (west). Table 6 shows the percentage of time logged in each IQUA category. For the largest majority of the time, air quality was in the "good" category during 2008 (more than 99% of the time).

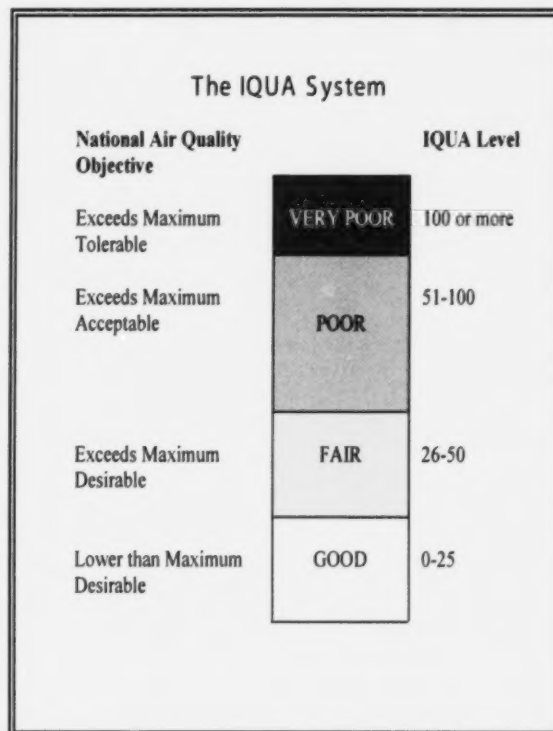


Table 6. Percentage of time in each IQUA Category for Saint John sites, 2008.

	Good (0-25)	Fair (26-50)	Poor (51-100)	Very Poor (over 100)
Forest Hills	99.1	0.9	0.0	0.0
Customs	99.6	0.4	0.0	0.0
Westside St.	99.5	0.5	0.0	0.0

A.9 Air Quality Health Index (AQHI)

The AQHI offers a new approach to describing air quality conditions. Developed in Canada, this new national index is designed to more accurately describe the relationship between air quality conditions and associated health risks. The index provides specific advice for people that are especially vulnerable to the effects of air pollution as well as advice for the general public.

The index is on a scale of 1-10+ and the higher the number, the greater the health risk and the need to take precautions. There are four categories of risk, low (1-3), moderate (4-6), high (7-10) and very high (>10). Each category has suggestions for individuals to reduce exposure, depending upon their sensitivity to air pollution.

The AQHI was officially introduced to Saint John on June 15, 2008. Each hour an index value is calculated for the entire city by averaging results of air quality monitoring conducted at the Customs Building, Castle Street, Forest Hills and

Hillcrest monitoring sites. Results from June 1 to December 31 are summarized in Figure 4. The vast majority of this period was represented by the low risk category. The AQHI for Saint John is available via the following national websites: www.airhealth.ca or www.weatheroffice.ec.gc.ca. Information is also available by phone by calling toll free in New Brunswick: 1-888-484-AQHI (2744).

Compared to IQUA, the AQHI is considered to be a better personal health protection tool and plans are being made to expand the AQHI to other communities in New Brunswick in 2010. Eventually, as people become familiar with the AQHI, the IQUA program will be terminated.

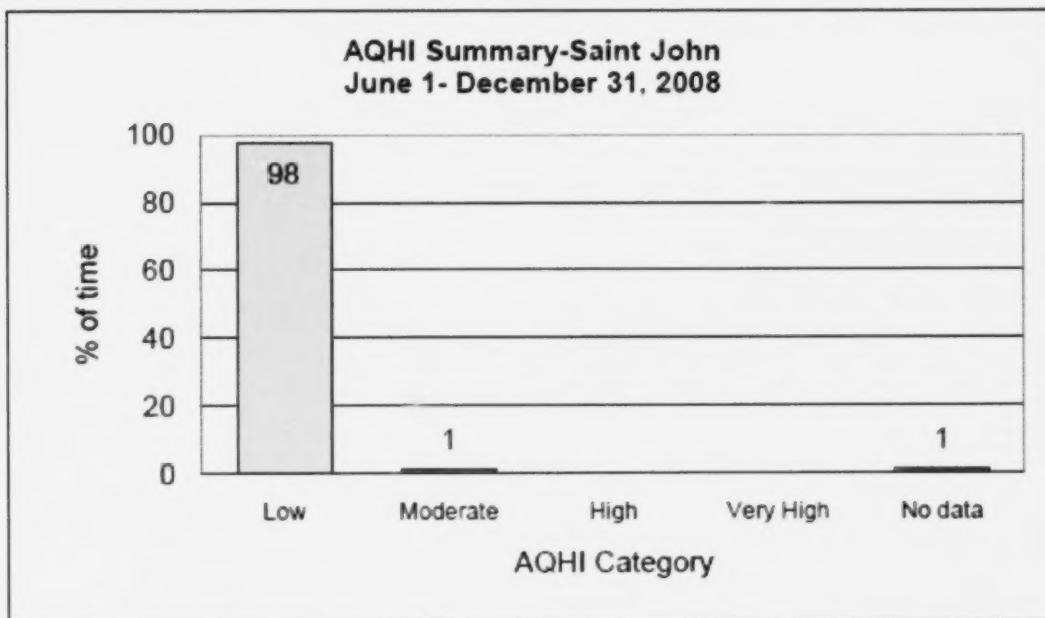


Figure 4. AQHI Summary for Saint John, June 1 - December 31, 2008.

B. MIRAMICHI

Two of the three monitoring sub-networks in the Miramichi region, one centered on the UPM pulp mill and one operated by the Weyerhaeuser Company were not operating in 2008 after both mills were permanently shut down during the previous year. The remaining sub-network centered on NB Power's Millbank gas turbine remains in place. Pollutants of concern at these two sites include SO₂, NO₂ and TSP.

Figure 5 shows the locations of the sites for the Millbank sub-network.

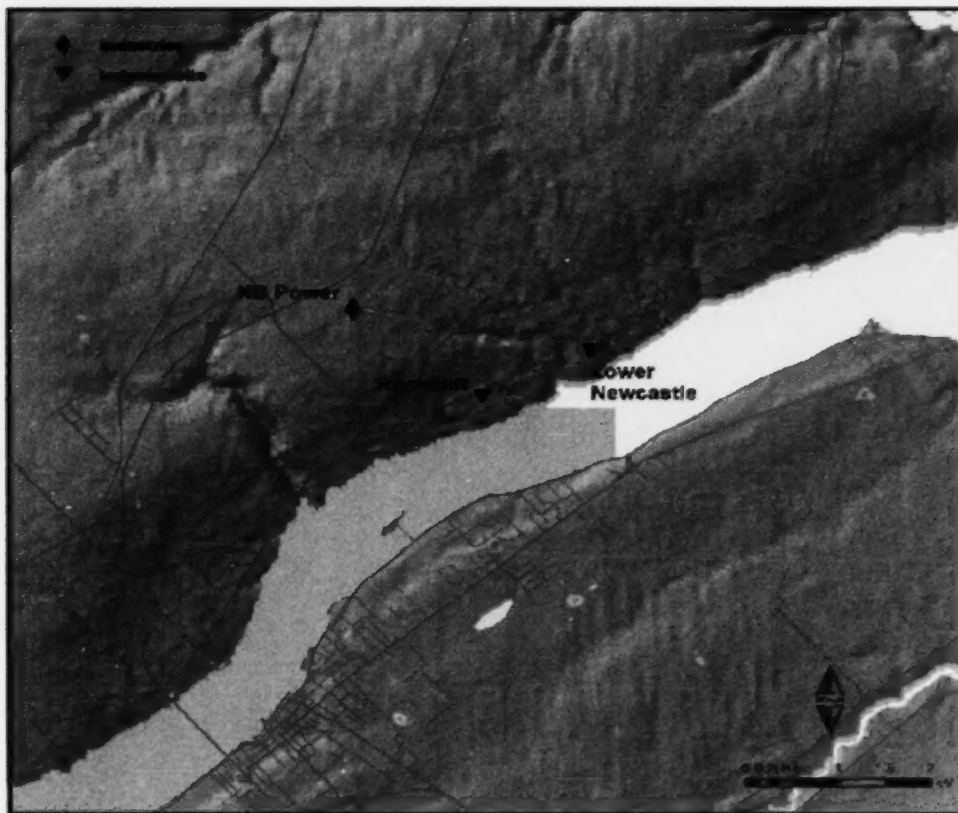


Figure 5. Air quality monitoring sites in the Miramichi Region, 2008.

B.1 MILLBANK NETWORK

The two sites at Millbank are positioned to assess the impact of NB Power's gas turbine generating station. The pollutants monitored include SO₂, NO₂ and TSP (Rockcliff only). Since 1997, there

have been no exceedances for SO₂, NO₂ or TSP logged in this network. Monthly results are shown in Appendix 1.

C. GRAND LAKE - NB POWER

Figure 6 shows the locations of the four monitoring sites in this network. These are sited to monitor the effects of the Grand Lake coal-fired electrical generating station and associated activities. The four monitoring sites are operated by NB Power and each measures SO_2 and TSP.

C.1 Sulphur Dioxide

In 2008, there were no exceedances of the 1-hour or the 24-hour standard for SO_2 at any of the four monitoring sites in this network. Compliance statistics for SO_2 since 1999 are shown in Table 7.

C.2 Total Suspended Particulate

In 2008, there were no exceedances of the 24-hour standard of $120 \mu\text{g}/\text{m}^3$ in this network. Complete results are given in Appendix 1. Compliance statistics for TSP since 1999 are shown in Table 8.

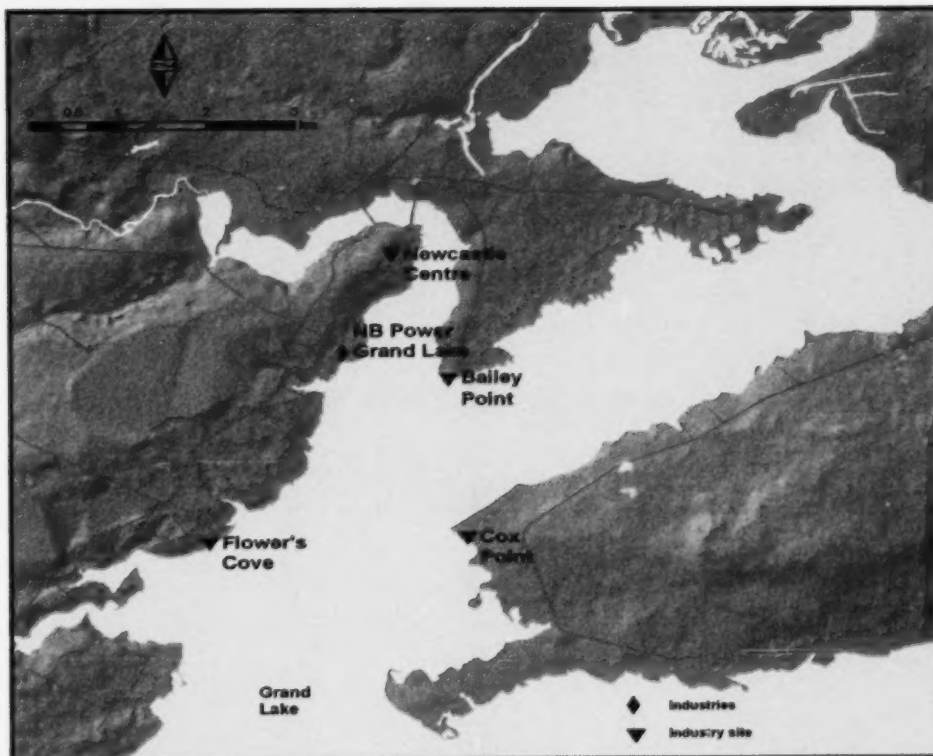


Figure 6. Air quality monitoring sites in the Grand Lake Network, 2008.

Table 7. Exceedances of provincial objectives for SO₂, NB Power Grand Lake Network, 1999-2008.

		Bailey Pt.	Cox Pt.	Flower's Cove	Newcastle Centre
2008	1-hour	0	0	0	0
2007	1-hour	2	0	0	4
2006	1-hour	0	0	0	0
2005	1-hour	0	0	0	1
2004	1-hour	1	0	1	6
2003	1-hour	1	0	2	5
2002	1-hour	0	0	3	3
2001	1-hour	0	2	0	0
2000	1-hour	0	0	0	2
1999	1-hour	0	0	0	4
2008	24-hour	0	0	0	0
2007	24-hour	0	0	0	0
2006	24-hour	0	0	0	0
2005	24-hour	0	0	0	0
2004	24-hour	0	0	0	0
2003	24-hour	0	0	0	0
2002	24-hour	0	0	0	0
2001	24-hour	0	0	0	0
2000	24-hour	0	0	0	0
1999	24-hour	0	0	0	0

Table 8. Exceedances of provincial objectives for TSP, NB Power Grand Lake Network, 1999-2008.

		Bailey Pt.	Cox Pt.	Flower's Cove	Newcastle Centre
2008	24-hour	0	0	0	0
2007	24-hour	0	0	0	0
2006	24-hour	0	0	0	0
2005	24-hour	0	0	0	0
2004	24-hour	0	0	0	0
2003	24-hour	0	0	0	0
2002	24-hour	0	0	0	0
2001	24-hour	0	0	0	0
2000	24-hour	0	0	0	0
1999	24-hour	0	0	1	0

D. LAKE UTOPIA PAPER (J.D. IRVING)

There were no exceedances reported for the 1-hour objective of 170 ppb or the 24-hour objective of 56 ppb for SO₂ in 2008 at the Lake Utopia Irving Paper Station (see Appendix 1). Lake Utopia Paper is located in Charlotte County where the SO₂ objective is half of the provincial objective.

E. EDMUNDSTON – FRASER PAPERS INC.

Figure 7 shows the locations of the monitoring sites, located primarily to monitor the impacts of the Fraser Papers Inc. pulp mill.

E.1 Sulphur Dioxide

In 2008, there was one exceedance of the 1-hour SO₂ objective at the Cormier School site that resulted from a fire in the molten sulphur tank. Compliance statistics for SO₂ since 2002 are shown in Table 9.

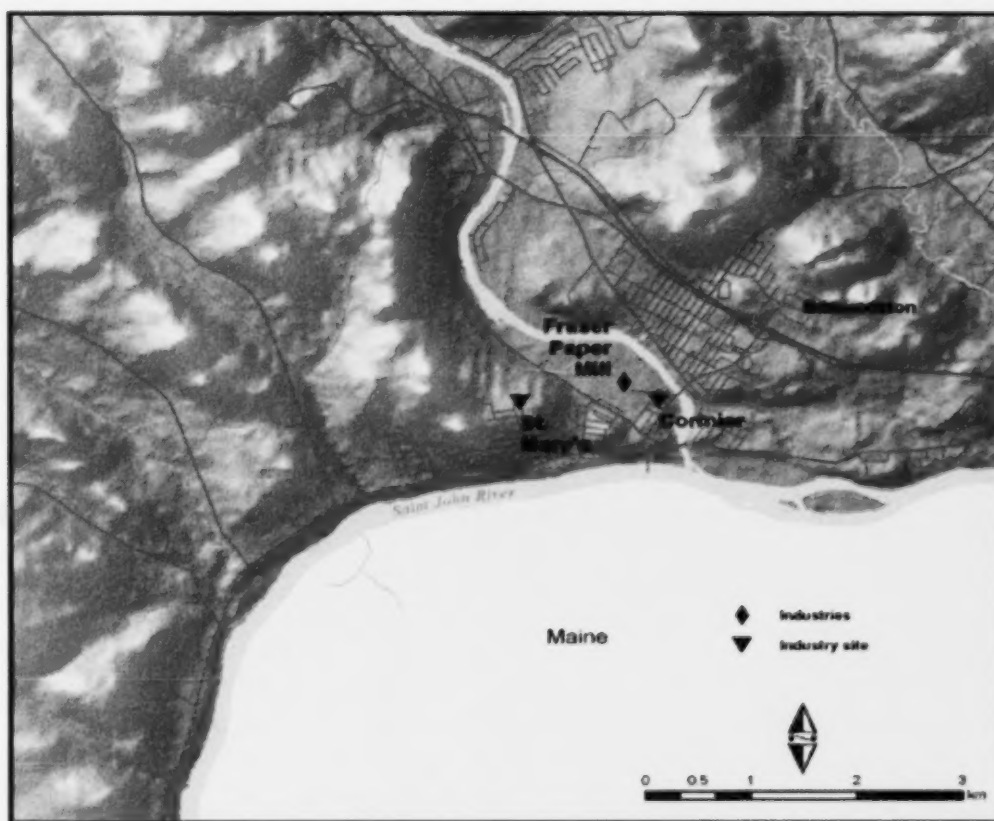


Figure 7. Air quality monitoring sites in Edmundston, 2008.

Table 9. Exceedances of provincial objectives for SO₂, Fraser Papers Inc. Edmunston Network, 2002-2008.

		Cormier School	St. Mary's
2008	1-hour	1	0
2007	1-hour	0	0
2006	1-hour	0	0
2005	1-hour	0	0
2004	1-hour	0	0
2003	1-hour	0	0
2002	1-hour	0	0
2008	24-hour	0	0
2007	24-hour	0	0
2006	24-hour	0	0
2005	24-hour	0	0
2004	24-hour	0	0
2003	24-hour	0	0
2002	24-hour	40	0

E.2. Particulate Matter

Table 10 summarizes results for PM_{2.5} measurements at the Cormier School site in 2008. This site employs TEOM technology for measuring PM_{2.5}.

There were no instances where the daily average value exceeded 30 µg/m³ and the annual average of 6.5 µg/m³ was lower than the previous year's value of 7.3 µg/m³. Additional results are shown in Appendix 1.

Table 10. Monitoring results for PM_{2.5} (TEOM), Fraser Papers Inc., Edmunston, 2008.

	Cormier
Annual average (µg/m ³)	6.5
98 th percentile value (CWS)	19.1
Days with daily average >30 µg/m ³	0
Hours with running 24-hour average >30 µg/m ³	0

F. BELLEDUNE

There are a number of monitoring sites in the Belledune region. Three of these are located for the assessment of emissions from the Xstrata complex. A further five monitors are operated for the assessment of NB Power's coal-fired electrical generating station.

Figure 8 shows the locations of all the monitoring sites in the region.

F.1 Xstrata

All sites in the Xstrata network monitor SO_2 and TSP.

F.1.1 Sulphur Dioxide

In 2008, there were two exceedances of the 1-hour objective at the Boulay station. Compliance statistics for SO_2 since 1999 are shown in Table 11.

F.1.2 Total Suspended Particulate

In 2008, there was one exceedance of TSP at the Townsite station. Compliance statistics for TSP since 1999 are shown in Table 12.

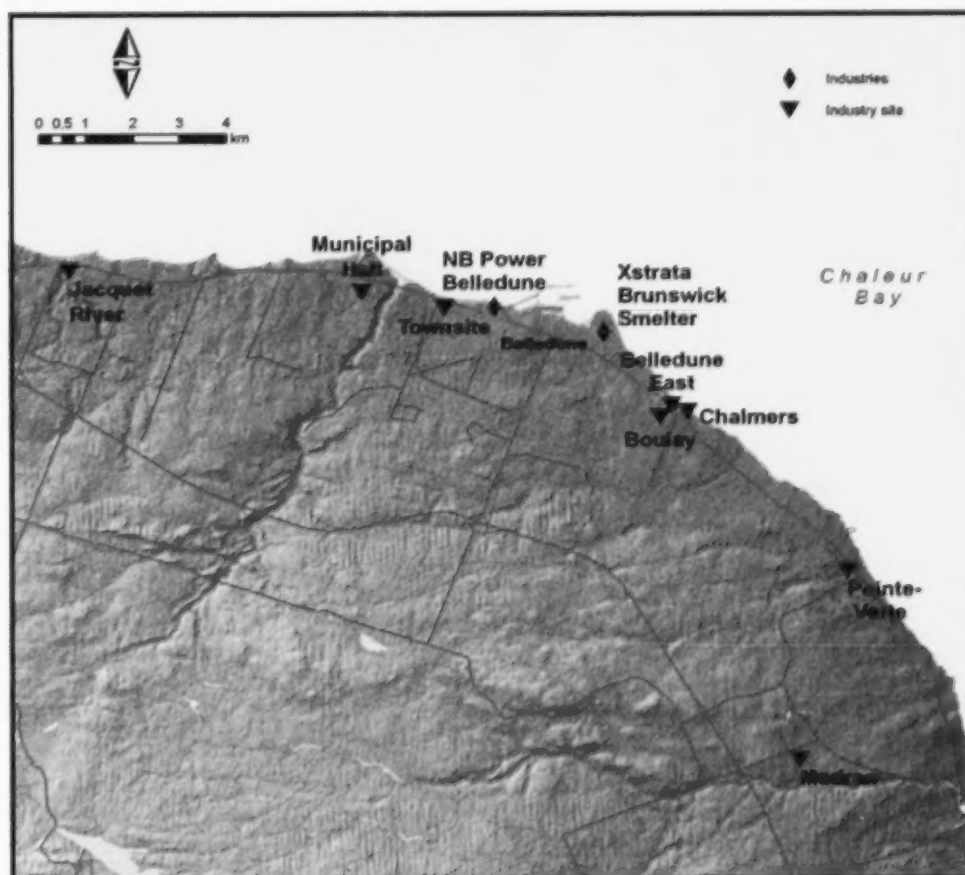


Figure 8. Air quality monitoring sites in the Belledune Network, 2008.

Table 11. Exceedances of provincial objectives for SO₂, Xstrata, 1999-2008.

Year	Objective	Boulay	Chalmers	Townsite
2008	1-hour	2	0	0
2007	1-hour	0	0	0
2006	1-hour	1	0	1
2005	1-hour	0	1	1
2004	1-hour	0	0	0
2003	1-hour			
2002	1-hour	1	3	0
2001	1-hour	4	2	0
2000	1-hour	2	1	1
1999	1-hour	1	1	1
2008	24-hour	0	0	0
2007	24-hour	0	0	0
2006	24-hour	0	0	0
2005	24-hour	0	0	0
2004	24-hour	0	0	0
2003	24-hour			
2002	24-hour	0	0	0
2001	24-hour	0	0	0
2000	24-hour	0	0	0
1999	24-hour	0	0	0

Note: In 2003, data were available only for the period January-June.

Table 12. Exceedances of provincial objectives for TSP, Xstrata, 1999-2008.

Year	Objective	Boulay	Chalmers	Townsite
2008	24-hour	0	0	1
2007	24-hour	0	0	0
2006	24-hour	0	0	0
2005	24-hour	0	0	0
2004	24-hour	0	0	0
2003	24-hour			
2002	24-hour		0	0
2001	24-hour		0	0
2000	24-hour		0	1
1999	24-hour		0	0

F.2 NB POWER

There are five sites in this network (see Table 13), all of which monitor SO₂. Belledune East and Municipal Hall also monitor NO₂.

F.2.1 Sulphur Dioxide

During 2008, there was one exceedance of the 1-hour SO₂ objective at the Belledune East site. Compliance statistics for SO₂ since 1999 are shown in Table 13.

F.2.2 Nitrogen Dioxide

This contaminant is measured at Belledune East and Municipal Hall. There were no exceedances of the applicable 1-hour or 24-hour objectives in 2008 at either location. There have been no exceedances of NO₂ recorded in this network since 1999.

Table 13. Exceedances of provincial objectives for SO₂, NB Power Belledune Network, 1999-2008.

Year	Objective	Belledune East	Jacquet River	Madran	Municipal Hall	Pointe Verte
2008	1-hour	1	0	0	0	0
2007	1-hour	0	0	0	0	0
2006	1-hour	1	0	0	1	0
2005	1-hour	0	3	0	0	0
2004	1-hour	0	0	0	0	0
2003	1-hour	3	0	0	1	0
2002	1-hour	4	0	0	0	1
2001	1-hour	2	0	0	1	0
2000	1-hour	2	0	0	1	0
1999	1-hour	1	0	0	0	0
2008	24-hour	0	0	0	0	0
2007	24-hour	0	0	0	0	0
2006	24-hour	0	0	0	0	0
2005	24-hour	0	0	0	0	0
2004	24-hour	0	0	0	0	0
2003	24-hour	0	0	0	0	0
2002	24-hour	0	0	0	0	0
2001	24-hour	0	0	0	0	0
2000	24-hour	0	0	0	0	0
1999	24-hour	0	0	0	0	0

G. DALHOUSIE – NB POWER

Figure 9 shows the locations of the sites in the Dalhousie region. The sites in this region are operated to monitor the effects of the NB Power Dalhousie electrical generating station. Six sites measure SO_2 . One of these sites also monitors TSP, and there is one additional TSP site, for a total of 7 sites. Because of potential pollution transport across the Bay of Chaleur, one of the stations is located in the province of Québec.

G.1 Sulphur Dioxide

Compliance with the applicable 1-hour, 24-hour and annual objectives was 100% at all sites in

2008. Detailed summaries are given in Appendix 1. There have been no exceedances of SO_2 recorded in this network since 1998.

G.2 Total Suspended Particulate

TSP was measured at the Coal Berm and Dalhousie Tower sites. Results are shown in Appendix 1. None of the individual readings obtained was above the 24-hour objective of $120 \mu\text{g}/\text{m}^3$ in 2008, and the annual geometric means were also below $12 \mu\text{g}/\text{m}^3$ (the standard is $70 \mu\text{g}/\text{m}^3$). There have been no exceedances of TSP recorded in this network since 1998.

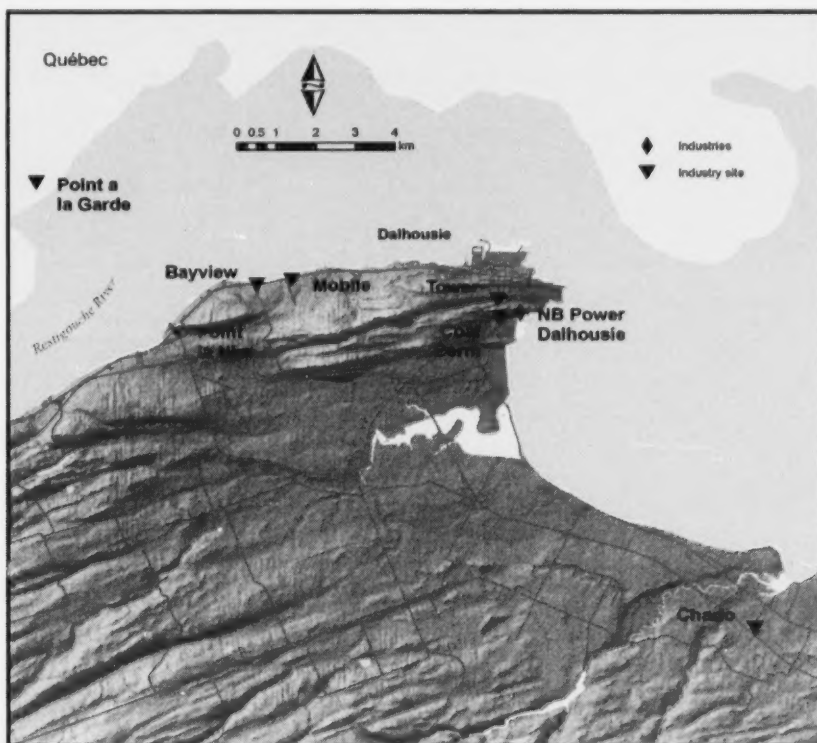


Figure 9. Air quality monitoring sites in the Dalhousie Network, 2008.

H. ATHOLVILLE - AV CELL INC.

H.1 Sulphur Dioxide

AV Cell Inc. operates a pulp mill in Atholville, and maintains two associated ambient air monitoring sites, Boom Road (to the west of the mill) and Beauvista (east). Sulphur dioxide is measured at both sites.

Compliance during 2008 was 100% with no exceedances of the 1-hour objective (340 ppb), 24-hour objective (113 ppb) or the annual objective (23 ppb) at either site. Compliance statistics for SO_2 since 2000 are shown in Table 14.

Table 14. Exceedances of provincial objectives for SO₂,
AV Cell Inc. Network, 2000-2008.

Year	Objective	Boom Rd (W)	Beauvista (E)
2008	1-hour	0	0
2007	1-hour	0	0
2006	1-hour	0	0
2005	1-hour	0	0
2004	1-hour	0	0
2003	1-hour	0	0
2002	1-hour	0	0
2001	1-hour	0	0
2000	1-hour	1	0
2008	24-hour	0	0
2007	24-hour	0	0
2006	24-hour	0	0
2005	24-hour	0	0
2004	24-hour	0	0
2003	24-hour	0	0
2002	24-hour	0	0
2001	24-hour	0	0
2000	24-hour	0	0

I. BATHURST

H.2 Nitrogen Dioxide

As follow-up to a dispersion modeling exercise, AV Cell Inc. was requested by DENV to monitor levels of nitrogen dioxide. Monitoring was split between two sites, Boom Road and Beauvista monitoring stations, beginning in December 2006 and continuing until August 2008.

After a total of 527 days of monitoring, no exceedances of the 1-hour air quality objective of 210 ppb or the 24-hour objective of 105 ppb for NO₂ were recorded. The maximum 1-hour value recorded was 38 ppb, the maximum 24-hour value was 26 ppb and the annual average was 8 ppb. NOX monitoring is no longer required at the mill.

I.1 Ground Level Ozone

There were no exceedances of the national 1-hour objective for ozone during 2008.

I.2 Particulate Matter

Levels of fine particulate remained below the CWS value of 30 µg/m³ in 2008. The annual average was 6.3 µg/m³. Results are summarized in Table 15.

Table 15. Monitoring results for PM_{2.5}, Bathurst, 2008.

	Rough Waters Drive
Annual average ($\mu\text{g}/\text{m}^3$)	6.3
98 th percentile value (CWS)	16.1
Days with daily average $>30 \mu\text{g}/\text{m}^3$	0
Hours with running 24-hour average $>30 \mu\text{g}/\text{m}^3$	0

J. FREDERICTON

The Fredericton site is on Aberdeen Street, in an area representative of the "downtown" residential and business district. This site is also considered representative of a wider area for pollutants, such as ozone, which are regional in nature.

J.1 Carbon Monoxide

No exceedances of the 1-hour or 8-hour objectives (30 ppm and 13 ppm respectively) were recorded. There have been no exceedances of CO at this site since it was established in 1999.

J.2 Nitrogen Dioxide

No exceedances of the 1-hour or 24-hour objectives (210 ppb and 105 ppb respectively) were recorded. There have been no exceedances of NO₂ at this site since it was established in 1999.

J.3 Ground Level Ozone

There were no exceedances of the national 1-hour objective for ozone during 2008. There is additional discussion of data from the ozone network in section 8.

J.4 Particulate Matter

Fine particulate matter (PM_{2.5}) was measured at the Aberdeen Street site. Data obtained during 2008 indicated relatively low particulate concentrations. Data are summarised in Table 16.

J.5 Index of the Quality of the Air

Results for 2008 showed air quality in the "good" category for 98.1% of the time, with 1.9% in the "fair" range. Ozone was responsible for the small number of hours in the fair range. Results were made available hourly via recorded voice message at (506) 451-6000.

Table 16. Monitoring results for PM_{2.5}, Fredericton, 2008.

	Aberdeen St.
Annual average ($\mu\text{g}/\text{m}^3$)	4.0
98 th percentile value (CWS)	14.8
Days with daily average $>30 \mu\text{g}/\text{m}^3$	0
Hours with running 24-hour average $>30 \mu\text{g}/\text{m}^3$	0

K. NACKAWIC

The former Ste. Anne Nackawic Kraft Mill closed its doors in September 2004 and was reopened under new ownership as AV Nackawic Inc. in January 2006. Sulphur dioxide, total reduced sulphur and total suspended particulate as well as wind speed and direction are measured at the Caverhill Road site.

During 2008, there were no exceedences of the 1-hour or 24-hour TRS objectives detected at the Caverhill Road site.

The compliance history for TRS since 2000 is shown in Table 17. In regards to SO₂ and TSP, no exceedences were recorded at this site during 2008. Complete results are shown in Appendix 1.

Table 17. Exceedences of provincial objectives for TRS (as H₂S), Nackawic Network, 2000-2008.

Year	Objective	Caverhill Road
2008	1-hour	0
2007	1-hour	1
2006	1-hour	1
2005	1-hour	M
2004	1-hour	6
2003	1-hour	1
2002	1-hour	6
2001	1-hour	0
2000	1-hour	6
2008	24-hour	0
2007	24-hour	181
2006	24-hour	0
2005	24-hour	M
2004	24-hour	19
2003	24-hour	0
2002	24-hour	0
2001	24-hour	0
2000	24-hour	0

Note: results for 2004 based on 8 months of operation. The Nackawic mill was shut down in September 2004 and was reopened under new ownership in January 2006.

M= missing data.

L. MONCTON

The Moncton air quality monitoring site is situated at the Highfield Street water pumping station. The site location was chosen to provide readings representative of the central city. In addition, this site is influenced by emissions from vehicles or institutional heating systems, as well as regional pollutants such as ozone.

L.1 Carbon Monoxide

Readings remain well below air quality objectives for carbon monoxide with no exceedences of hourly or 8-hourly objectives for carbon monoxide occurring during 2008.

L.2 Nitrogen Dioxide

No exceedences of hourly or 24-hour standards for nitrogen dioxide were recorded during 2008. No exceedences of NO₂ objectives have been recorded since monitoring began in 1998.

L.3 Ground Level Ozone

There were no exceedences of the hourly objective for ozone (82 ppb). More discussion of ozone data may be found in the section on long term trends.

L.4 Particulate Matter

Levels of fine particulate are, on average, moderately higher at this site than at the Fredericton site. Data are summarized in Table 18. No exceedences of the CWS level of 30 µg/m³ occurred at this site in 2008. Complete results are shown in Appendix 1.

L.5 Index of the Quality of the Air

Hourly IQUA reports are generated for the Moncton site and made available via recorded message at (506) 851-6610. Summary statistics for 2008 indicated that good air quality was recorded for 99.2% of all hours, and fair for 0.8%.

Table 18. Monitoring results for PM_{2.5}, Moncton, 2008.

	Highfield St.
Annual average ($\mu\text{g}/\text{m}^3$)	5.9
98 th percentile value (CWS)	17.4
Days with daily average $>30 \mu\text{g}/\text{m}^3$	0
Hours with running 24-hour average $>30 \mu\text{g}/\text{m}^3$	0

M. ST. ANDREWS

The St. Andrews monitoring station is located on the grounds of the Huntsman Marine Science Centre (H.M.S.C.) and is operated with the support of staff from the Centre and DENV. Currently, projects operated at St. Andrews by the province include ozone and PM_{2.5} monitoring.

M.2 Ground Level Ozone

There were no exceedances of the national 1-hour objective for ozone during 2008. There is additional discussion of data from the ozone network in section 8.

M.1 Particulate Matter

In general, readings were low at this site. Data are summarized in Table 19. Complete results are shown in Appendix 1.

Table 19. Monitoring results for PM_{2.5}, St Andrews, 2008.

	H.M.S.C.
Annual average ($\mu\text{g}/\text{m}^3$)	4.2
98 th percentile value (CWS)	13.7
Days with daily average $>30 \mu\text{g}/\text{m}^3$	0
Hours with running 24-hour average $>30 \mu\text{g}/\text{m}^3$	0

4. RURAL OZONE NETWORK

Figure 10 shows the locations of the sites which monitor ground level ozone in New Brunswick. This network is operated to assess the impact of long-range transport. It focuses on the southern portion of the province, which is the region most affected by long range transport, as shown by special short-term monitoring studies and trajectory analyses (e.g. Fuentes and Dann, 1994; Tordon et al., 1994; Multistakeholder NOx/VOC Science Program, 1997a, 1997b). Ozone monitoring at the Bathurst site commenced in May 2006.

There were no exceedances of the 1-hour objective of 82 ppb at any of the sites in the network during 2008. Results are summarised in Table 20. Monthly means and extremes for each site are shown in Appendix 1.



Figure 10. Locations of ozone monitoring sites in New Brunswick, 2008.

A. Air quality Advisories

DENV works with Environment Canada and the Department of Health and Wellness in the preparation and dissemination of daily forecasts of ozone. DENV maintains the monitoring network and supplies real-time data to Environment Canada forecasters, who issue twice-daily forecasts of ozone concentrations. When forecast data indicate that the 1-hour Air Quality Objective for ozone will be exceeded or closely approached, air quality and health advisories are issued to the media to provide advance notice to the public. Advisories may be issued for specific regions of the province.

In recent years, air quality advisories may also be issued when levels of fine particulate ($PM_{2.5}$) are expected to rise above $30 \mu g/m^3$ for an extended period. For example, when smoke from forest fire within the region are forecasted to affect air quality in New Brunswick.

There were no smog advisories issued by Environment Canada in 2008.

Table 20. Exceedances of the 1-hour ozone objective (number of hours), 2008.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Blissville													0
Canterbury													0
Customs													0
Forest Hills													0
Fredericton													0
Fundy Park													0
Hillcrest													0
Lower Newcastle													0
Mobile (Saint John)	-	-	-	-	-	-	-	-	-	-	-	-	--
Moncton													0
Norton													0
Pt. Lepreau													0
St. Andrews													0
St Leonard													0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0

The 1- hour National Objective is 82 ppb.

-- = missing data.

5. CANADA-WIDE STANDARDS (CWS)

A. Canada-wide Standard for Ozone

Figures 11 and 12 show Canada-wide Standard values from 2000 to 2008. Each plotted point is calculated as the average of three years ending at that time, i.e. the point for 2008 is the average for the years 2006-2008. The CWS for ozone is 65 ppb. Figure 11 shows results for urban

stations and results for rural sites are shown in Figure 12. In 2008, all sites remain below the CWS criterion.

The compliance date for achieving the Canada-wide Standards for ozone and $PM_{2.5}$ is 2010.

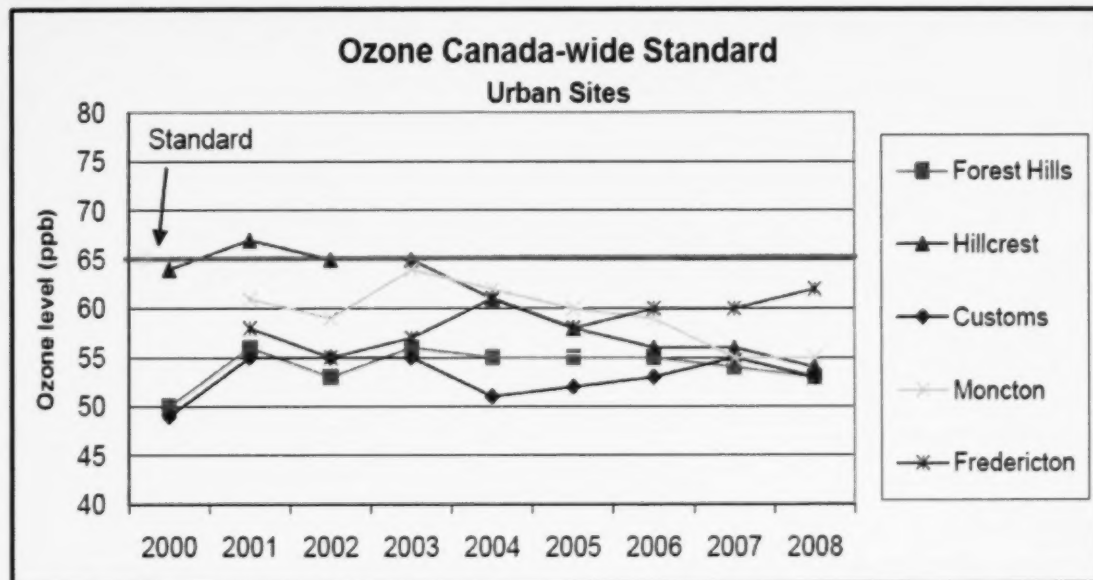


Figure 11. Canada-wide Standard results for ozone at urban sites, 2000-2008.

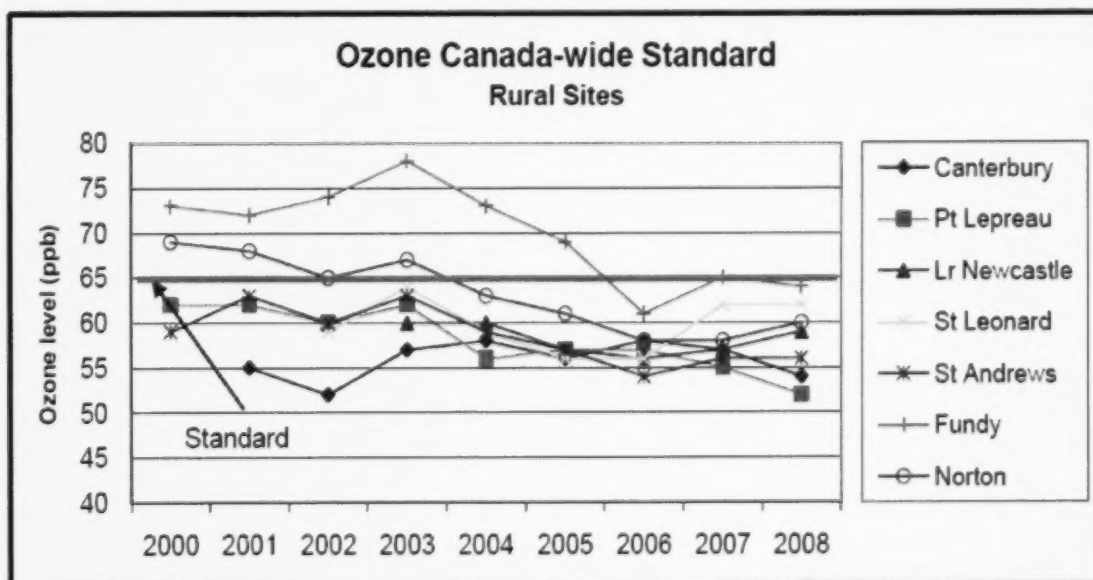


Figure 12. Canada-wide Standard results for ozone at rural sites, 2000-2008.

B. Canada-wide Standard for PM_{2.5}

Figures 13 and 14 show CWS results for PM_{2.5}. Figure 13 shows results for various sites in New Brunswick and Figure 14 shows results for stations in Saint John. The CWS for PM_{2.5} is 30 µg/m³. As with the ozone CWS charts, each plotted point

is a three-year average. The period of record varies between sites. Results at all stations have remained below the CWS standard to date.

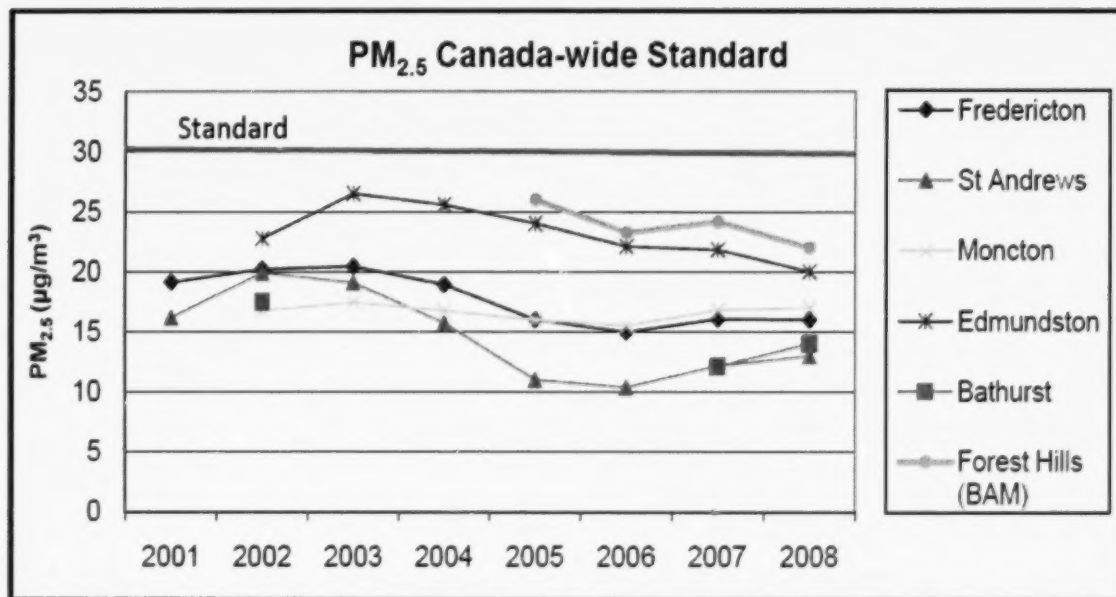


Figure 13. Canada-wide Standard results for PM_{2.5}, 2001-2008.

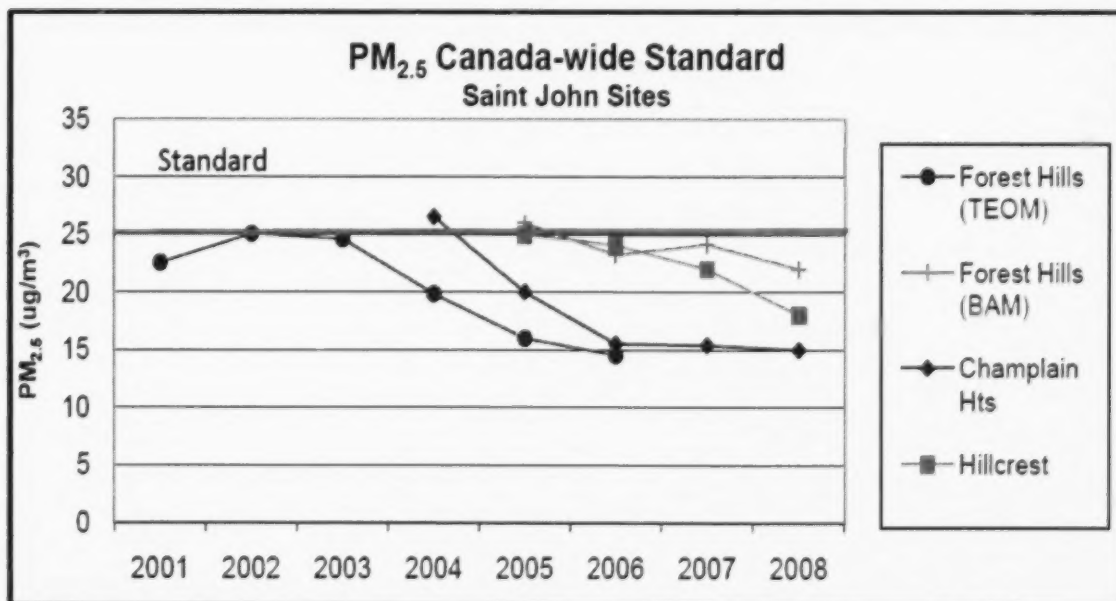


Figure 14. Canada-wide Standard results for PM_{2.5}, Saint John sites, 2001-2008

6. ACID PRECIPITATION NETWORK

Emissions of sulphur dioxide and nitrogen oxides can be transformed in the atmosphere to acidic particles which ultimately fallout as acid deposition, in both wet and dry form. Acid precipitation, or acid rain, refers to the wet form of acid deposition.

The potentially adverse impacts of acid precipitation have been recognized since the early 1980's. Acid precipitation effects occur at a broad regional level, not just close to the sources of the contaminants themselves. The emissions which cause acid precipitation typically travel long distances, hundreds or even thousands of kilometers, before returning to the surface in rain or snow. In New Brunswick, acid deposition is affected by local emissions and the emissions from several large industrial regions which are located upwind, including the American Midwest, southern Ontario and Québec, and the Washington-Boston region. The same emissions also contribute to regional haze and fine particulate pollution.

Consequently, measures to reduce emissions that contribute to acid rain have been underway in North America since the late 1980's. Over the past two decades sulphur dioxide emissions from major sources within New Brunswick have been reduced significantly including new commitments to reduce emissions under the Canada-wide Acid Rain Strategy for Post-2000.

New Brunswick has operated an extensive acid precipitation (rain and snow) monitoring network since the early 1980s. Since 1987, this has been a partnership effort with logistical and financial support from NB Power. In 2008 there were 13 acid precipitation monitoring stations in operation, which are predominantly located in remote rural areas. Figure 15 shows the location of the acid precipitation monitoring sites in New Brunswick. In 2008, the DENV site at Trout Brook was relocated a short distance to accommodate a



Figure 15. Location of acid rain monitoring sites in New Brunswick, 2008.

new site operator. All precipitation samples are analyzed at the DENV laboratory, and DENV staff co-ordinate the monitoring program, perform data quality assurance, and maintain the official data archive.

The severity of acid rain impact is generally measured by computing how much sulphate (a measure of sulphuric acid) falls on each hectare of land over one year. In Canada, critical loads are defined as the level of acidic deposition that a specific area can tolerate without harm. Critical loads take into account the nature of individual watersheds and their susceptibility to the effects of acidification. Critical loads for acidification in New Brunswick range from less than 8 up to 11 kg/ha/yr of acid sulphate deposition. The lowest values of less than 8 kg/ha/yr are designed to protect the most sensitive areas that typically have granite bedrock (e.g. areas of southwestern and central northern New Brunswick), and 11 kg/ha/yr for most of the rest of the Province.

Sulphate wet deposition for the 10 year period of 1999-2008 is shown in Table 21. At many of the sites in the network, acid deposition values in 2008 were slightly higher as compared to deposition levels in 2007. As concentration values

were generally lower in 2008, this could be due to the increased rainfall amounts in most areas of the province where acid precipitation monitoring stations are located. Acid deposition in 2008 ranged from as low as 7.79 kg/ha/yr at Coles Island to as high as 13.47 kg/ha/yr at Pennfield.

Although Canada and US emissions of sulphur dioxide and nitrogen oxides have continued to decline since 1990 (Canada-United States Air Quality Agreement: 2008 Progress Report), the acid rain issue remains important for New Brunswick because critical loads for acid rain continue to be exceeded, especially in southern NB. As a result, more effort to reduce emissions is required to reduce acid deposition further and ensure that the more sensitive lakes and rivers are provided with long-term protection from acid damage.

The amount of acid precipitation is a naturally variable indicator of acid deposition because it is closely associated with the amount of precipitation that falls during the course of the year at a given monitoring site. As a result, there will always be significant variability in annual deposition values as a function of rain and snow levels each year.

Table 21. Sulphate wet deposition (kg/ha/yr) at New Brunswick monitoring sites, 1999-2008

Site	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
St. Maure	11.18	9.73	7.14	8.08	8.53	7.77	10.63	10.54	10.16	10.49
Robertville	10.61	9.48	7.98	10.08	7.25	7.48	11.36	12.13	9.08	9.40
Petit Paquetville	9.36	8.89	8.33	7.64	7.24	7.11	10.07	10.86	8.79	8.10
Nictau	11.19	—	9.367	9.59	7.08	8.00	9.31	11.47	7.68***	7.94
Trout Brook	8.44	8.36	9.89	9.12	9.04	6.42	10.74	10.83	8.73	7.86
Holtville	9.79	11.48	8.94	10.58	10.75	8.29	12.01	12.21	8.81	10.92
Harcourt	9.05	9.82	7.50	10.00	9.81	7.27	9.50	10.31	8.09	10.17
Canterbury	9.8	10.49	8.46	10.47	9.58	7.32	13.53	—	—	9.43
Fundy	13.99	19.04	10.62	15.07	13.23	12.66	15.43	16.69	12.09	12.87
South Oromocto Lake	11.52	13.17	9.60	10.95	11.14	—	—	11.71	10.68	10.62
Lakewood Heights	13.27	16.36	10.17	14.94	16.89	12.83	13.01**	14.49	11.62	11.98
Pennfield	13.93	14.20*	10.49	13.30	12.03	12.12	16.45	15.53	11.45	13.47
Coles Island	9.35	12.28	7.44	10.84	10.62	8.28	9.20	9.07	8.95	7.79

— Insufficient data

* 41 Weeks reporting

** 48 Weeks reporting

*** 49 Weeks reporting

Total annual precipitation for the year was above normal over most of the Province. Only the Fredericton area and a small area along the east coast were in the normal range. The northern highlands received the greatest amount of precipitation, with a surplus of over 600mm for the year. (<http://www.gnb.ca/0009/0371/0007/2008/2008-E.asp>)

year. The trend overall is downward since 1989, with 2008 having the lowest recorded concentrations to date. The downward trend confirms that reductions in sulphur dioxide emissions in New Brunswick, elsewhere in eastern Canada and the United States have had a beneficial effect on acid rain in the province.

Another useful indicator of acid deposition is the average annual sulphate concentration in precipitation, averaged across all sites operating in each year. The results are shown in Figure 16, which also shows the number of sites that were in operation for at least a portion of each

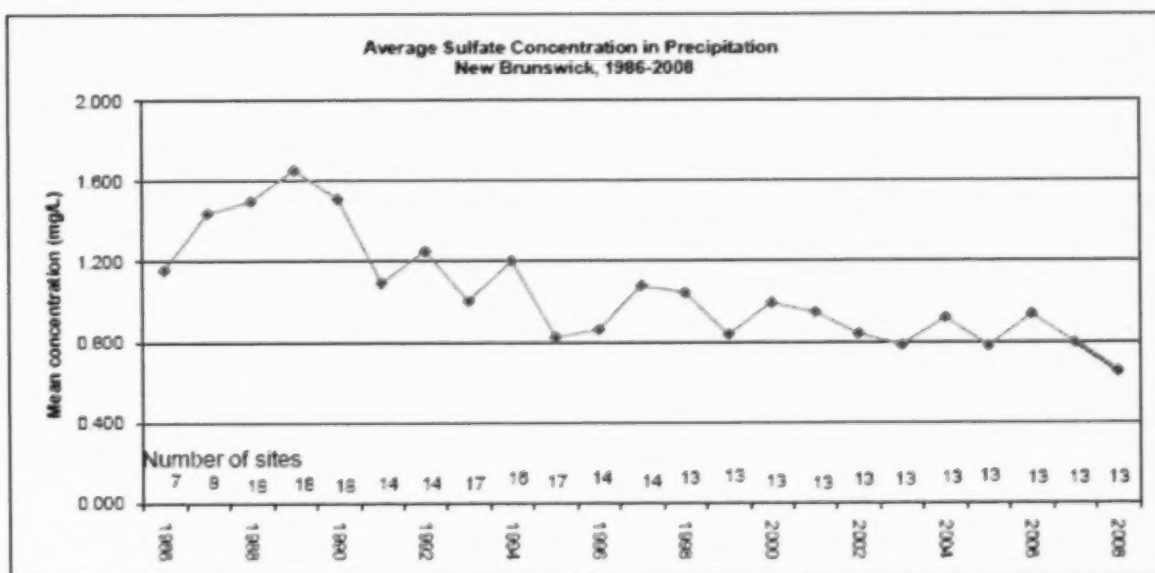
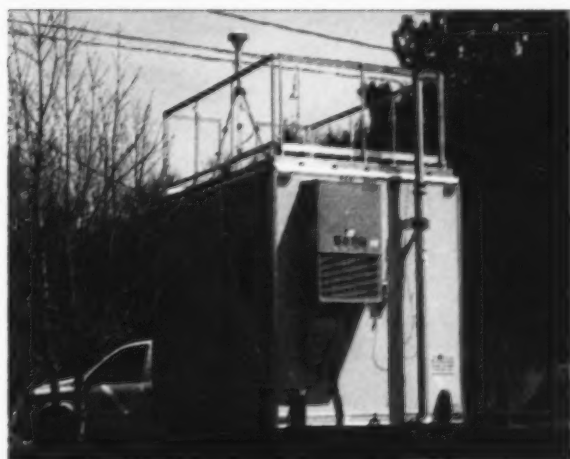


Figure 16. Network-wide mean annual sulphate concentration in precipitation in New Brunswick, 1986-2008.

7. MOBILE AIR QUALITY MONITORING UNIT

To help in evaluating air quality in New Brunswick, the DENV acquired a new stand-alone trailer from the NAPS program to replace an older mobile unit that had been in service since 2001. It augments monitoring carried out at established monitoring sites and can be moved to most areas of the province, fulfilling temporary monitoring needs. The vehicle is presently able to measure the following pollutants: sulphur dioxide, nitrogen oxides, ozone, total reduced sulphur (including hydrogen sulphide) and fine particulate matter ($PM_{2.5}$). The vehicle is also fitted with a retractable 10-metre mast with wind speed and direction instruments.



2008 Operations

Acquired in 2007 from NAPS, the DENV's new air monitoring trailer was put into service on Candace St. in the Vista Ridge area of east Saint John in early 2008 to measure levels of sulphur dioxide, total reduced sulphur, nitrogen dioxide and fine particulate. The purpose of the monitoring was to provide additional air quality information while the Irving refinery was installing new pollution control equipment, namely the Hydrogenation Amine Tail Gas Unit (HATGU). The possibility existed for increased emissions of sulphur dioxide during the installation, potentially affecting air quality levels in the area.

Table 22 summarizes results of the monitoring carried out at Candace St. between January 20 and September 12, 2008. For comparative purposes results from the Forest Hills monitoring

site, located about 0.7 kilometers to the west southwest of Candace St., are included for the same time period. There were no exceedances recorded for any of the four pollutants at the Candace St. location. Average concentrations for some pollutants were lower at Candace St. than at Forest Hills. For example, average levels of SO_2 and $PM_{2.5}$ at Candace St. were 0ppb and $3\mu g/m^3$ respectively, compared to 5ppb and $7\mu g/m^3$ respectively at Forest Hills during the same time period. Average NO_2 and TRS levels were the same at the two sites.

Table 22. Data Summary and Comparison for Mobile Air Monitoring Unit and Forest Hills. 2008.

January 30-September 12, 2008		
	Candace Street	Forest Hills
SO_2		
Coverage (%)	99	97
1-h exceedances (>170 ppb)	0	1
24-h exceedances (>56 ppb)	0	0
Max 1-hour average (ppb)	1	329
Average (ppb)	0	5
TRS		
Coverage (%)	95	90
1-h exceedances (>11 ppb)	0	0
24-h exceedances (>3.5 ppb)	0	0
Max 1-hour average (ppb)	4	3
Average (ppb)	0	0
NO_2		
Coverage (%)	61	90
1-h exceedances (>210 ppb)	0	0
24-h exceedances (>105 ppb)	0	0
Max 1-hour average (ppb)	36	33
Average (ppb)	3	3
$PM_{2.5}$	(TEOM)	(BAM)
Coverage (%)	85	89
Max 24-hour average ($\mu g/m^3$)	15	26
# of days daily avg >30 $\mu g/m^3$	0	0
Average ($\mu g/m^3$)	3	7

8. LONG TERM AIR POLLUTION TRENDS

In addition to examining air quality monitoring results for a given year, it is often informative and revealing to compare annual results to previous years, and consider longer term trends. This provides information on how air quality may be changing over the years, and whether emission control measures as applied to industrial operations and consumer products (notably vehicles and fuels) are influencing long-term environmental quality. As mentioned in the introduction, air quality monitoring has been ongoing in parts of the province since the 1970s, especially in the Saint John region. In this section, data for key locations with long-term records are presented to provide information on air quality trends.

A. Carbon Monoxide

Customs Building

The earlier part of the record (prior to 1991) is from the nearby Post Office location. Results are predominantly influenced by motor vehicle emissions. Generally, annual average levels of CO have improved over the long term since the 1980's. This could reflect the tighter vehicle emission standard resulting in lower emissions. In 2008, the annual average CO level of 0.2 ppm was the same as for 2007, which was the lowest on record.

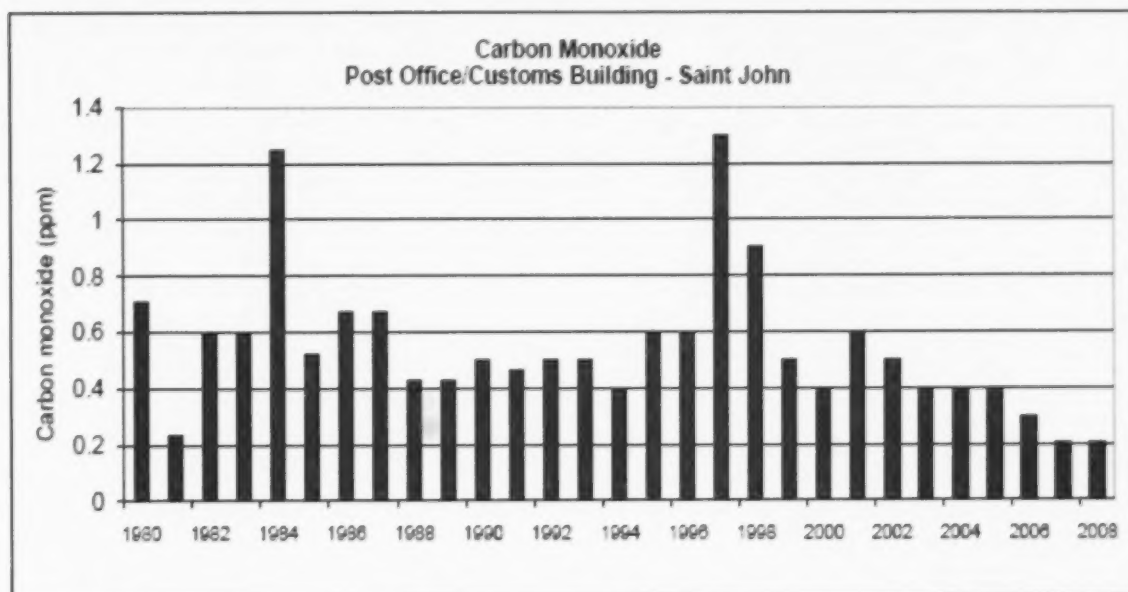


Figure 17. Annual mean carbon monoxide, Post Office/Customs Building, Saint John, 1980-2008.

Fredericton and Moncton

The record to date at these stations shows similar improvement as recorded at the Saint John-Customs location. CO in Moncton increased slightly in 2008, but is still in keeping with the overall downward trend since 1999. Levels in Fredericton have also improved since 2002.

B. Nitrogen Dioxide

Forest Hills

NO₂ is another key pollutant emitted by motor vehicles, as well as industrial sources. The overall NO₂ trend at this site has been downward since 1981.

Forest Hills is influenced by emissions from local industries as well as the more diffuse sources such as vehicles.

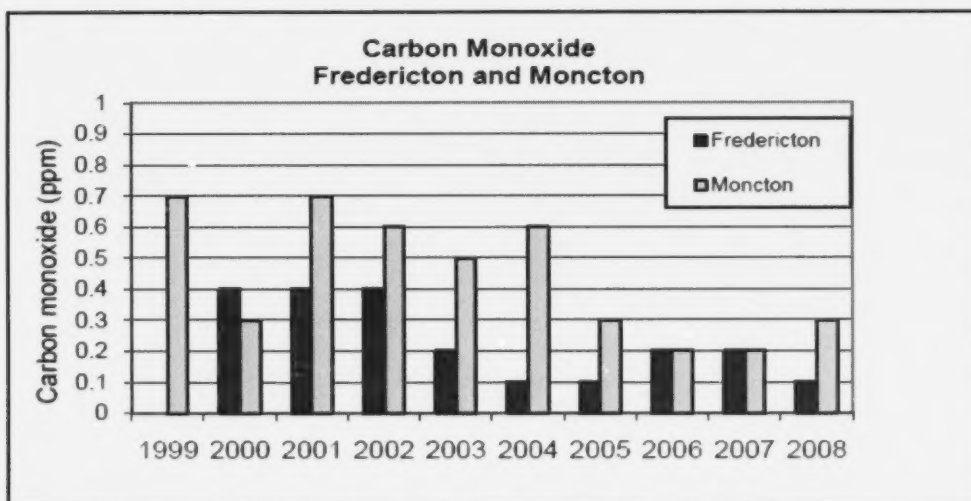


Figure 18. Annual mean carbon monoxide, Fredericton and Moncton, 1999 -2008.

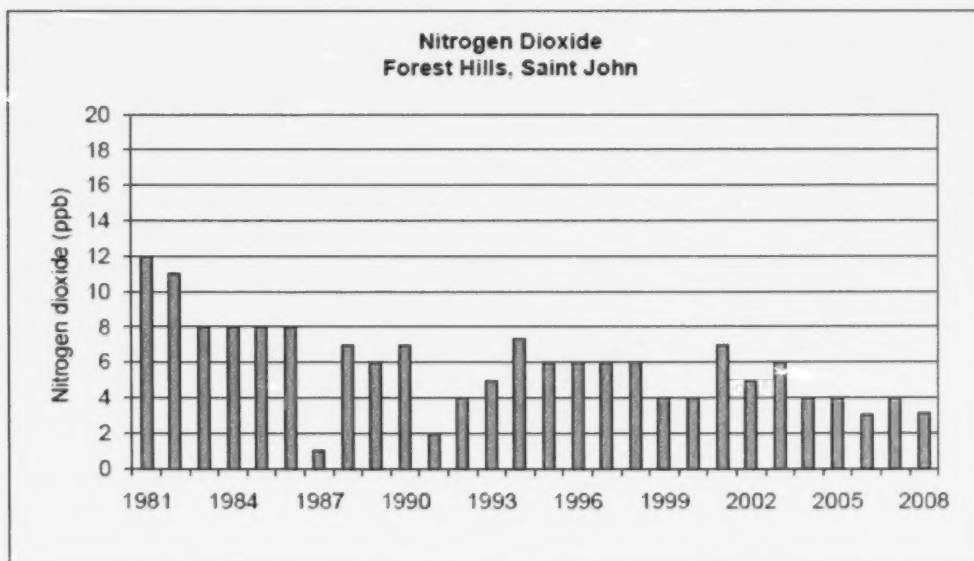


Figure 19. Annual mean nitrogen dioxide, Forest Hills, Saint John, 1981-2008.

Customs Building

In 2008, the annual mean continued its downward trend of recent years and stood at 5 ppb.

Fredericton and Moncton

The record for these centres is less than 10 years, but is presented for comparison. NO_2 values appear to be slightly higher on average at the Moncton station, but the trend is downward overall at both sites.

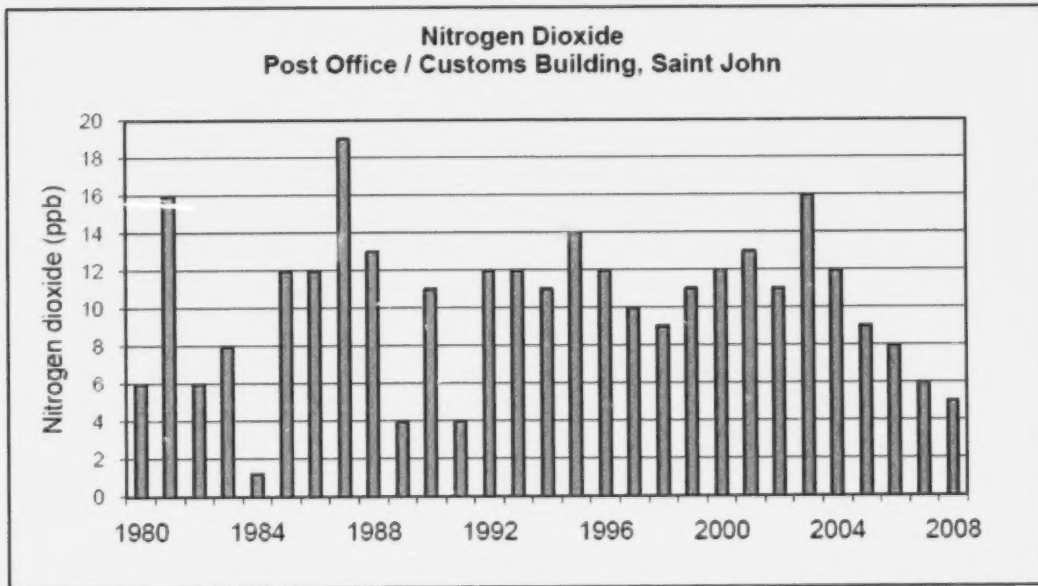


Figure 20. Annual mean nitrogen dioxide, Customs Building, Saint John, 1980-2008.

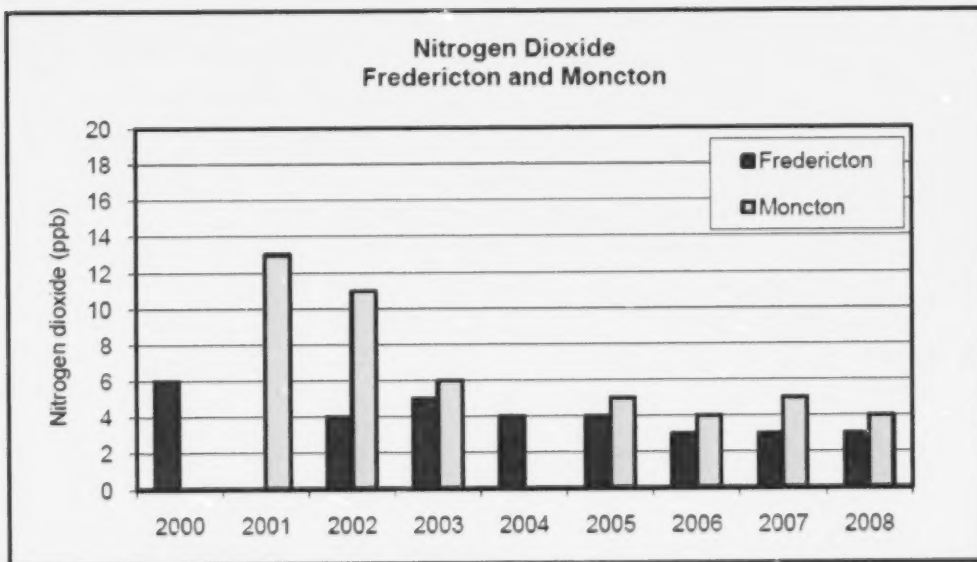


Figure 21. Annual mean nitrogen dioxide, Fredericton and Moncton, 2000-2008.

C. Sulphur Dioxide

Forest Hills

Figure 22 shows dramatic improvement in average SO_2 levels at Forest Hills over a 30 year period from 1977-2008. This reflects emission reductions that have been achieved by several

local industries including power generating stations, the pulp and paper industry and an oil refinery.

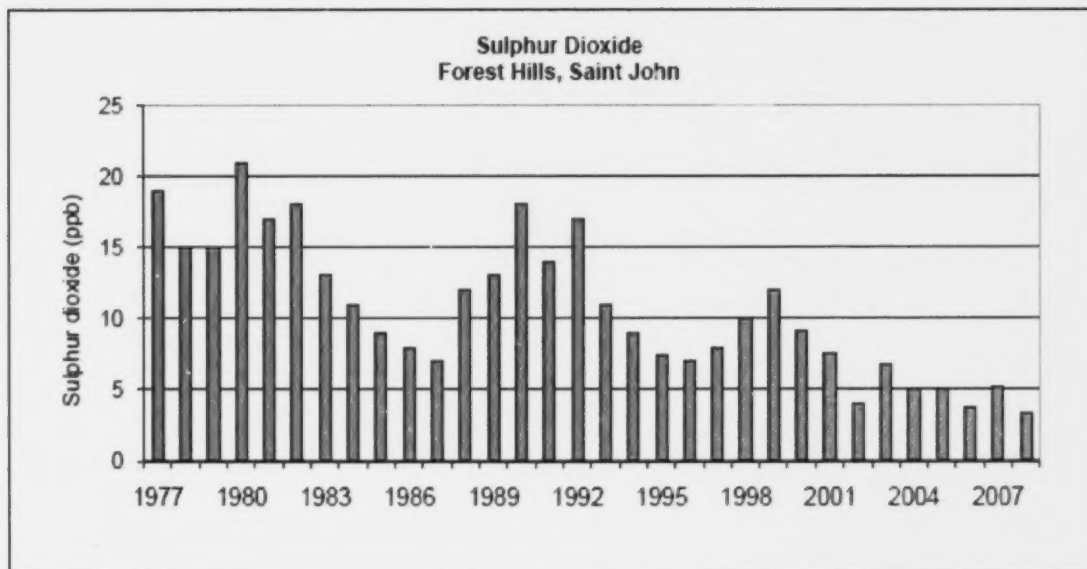


Figure 22. Annual mean sulphur dioxide, Forest Hills, Saint John, 1977-2008.

Customs Building

In uptown Saint John, as represented by records from the Post Office and Customs Building sites, the SO_2 trend has been downward since the mid-1970s. Decreasing concentrations in this part of the city are probably due to a variety of reasons, including reduced emissions from the Reversing Falls pulp and paper mill, which fell by about 70% from 1980 to 1995. Reduced emissions from the NB Power Courtenay Bay generating station (down 74% from 1990 to 1995) may also be partly responsible. Other reasons include the closure of

the Lantic sugar refinery in 2002, new regulations reducing the sulphur content of gasoline, and the increasing use of natural gas.

The annual mean in 2008 was 1 ppb (Figure 23).

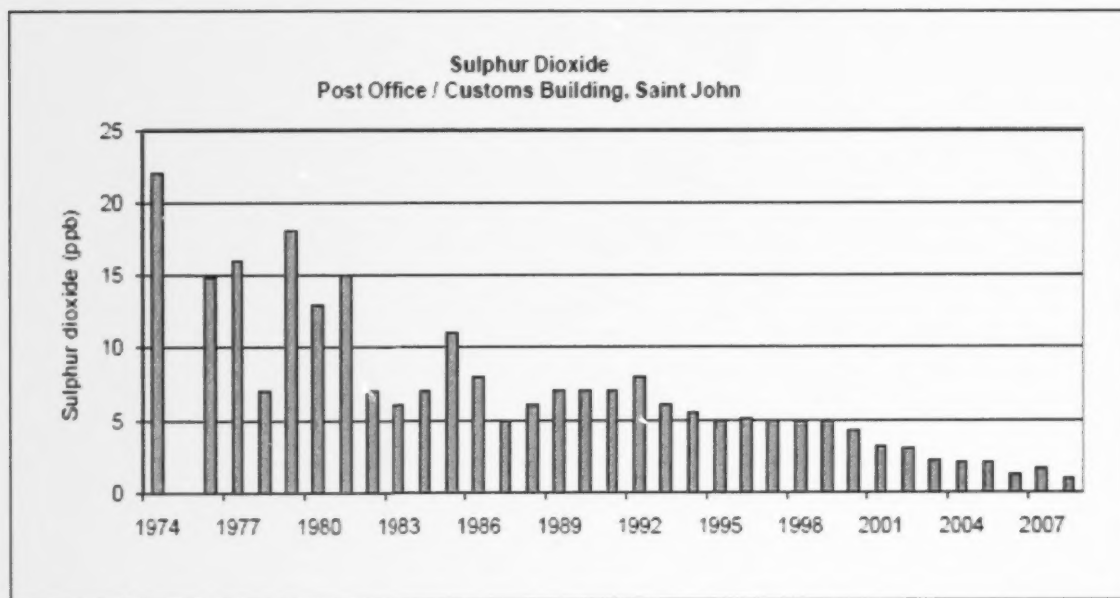


Figure 23. Annual mean sulphur dioxide, Post Office/Customs Building, Saint John, 1974-2008.

Hillcrest

This site in west Saint John is influenced by several sources of SO_2 , including the Reversing Falls pulp and paper mill and the Moosehead brewery. Since 1992, the data show a rising trend until 1997 and then falling thereafter. In 2008, the annual mean was 2 ppb (Figure 24).

Saint John – 3 Site Average

To examine the long term trend on a city-wide basis, a composite annual average of three sites (Hillcrest, Forest Hills and the Customs Building) operated by the DENV in the Saint John area was calculated. The trend is shown in Figure 25.

The results show average SO_2 level of 6-7 ppb during the 1990s, after which they began to decline to the point where in recent years average levels of 2-3 ppb occur.

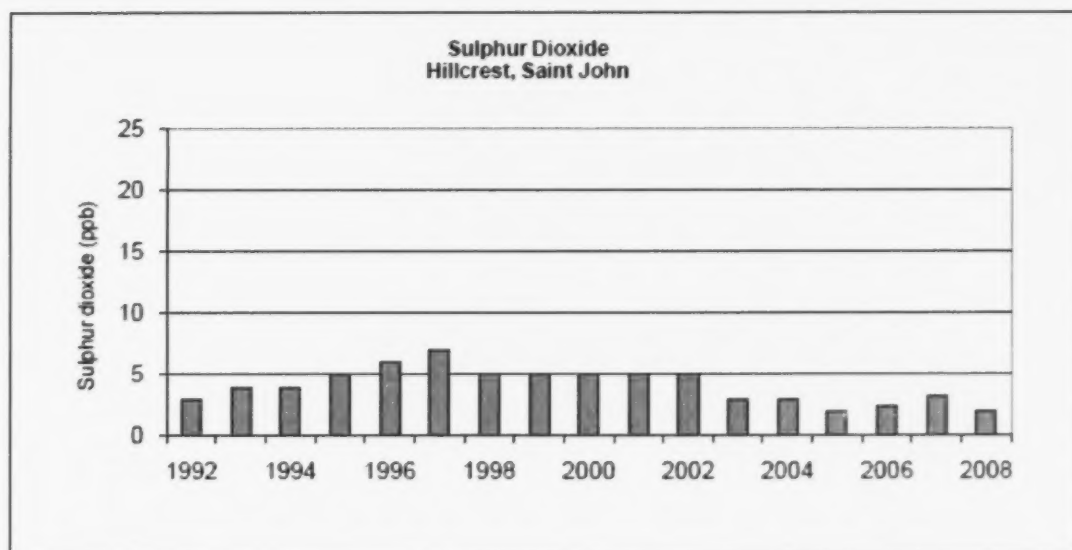


Figure 24. Annual mean sulphur dioxide, Hillcrest, Saint John, 1992-2008.

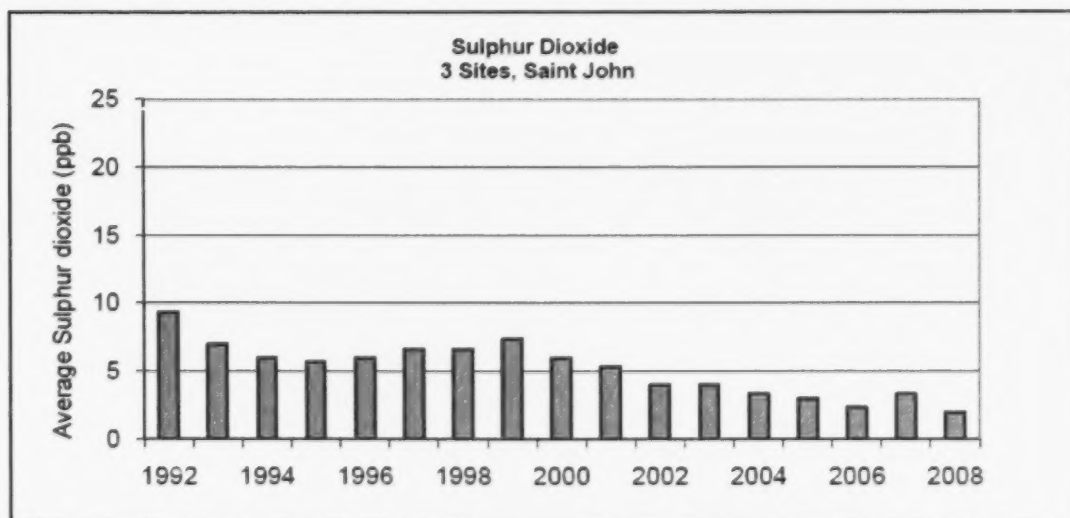


Figure 25. Trend in sulphur dioxide in Saint John, 3 site composite average, 1993-2008.

D. Ground Level Ozone

As explained in section 4, O_3 is a regionally transported pollutant which is not emitted directly from smokestacks or tailpipes, but which forms in the air when other pollutants mix and react together. As such, trends in O_3 are due to changing emissions of the pollutants that lead to O_3 formation (NO_2 and VOC) over a large upwind area of eastern Canada and the United States. Seasonal weather, especially summer conditions, also has a major influence on the amount of O_3 affecting New Brunswick.

Forest Hills

At Forest Hills O_3 levels do not appear to have changed significantly overall since the 1980s, when O_3 levels were first recorded at this site (Figure 26).

Customs Building

At the Customs site, annual averages for O_3 have also been variable over the period of record and like Forest Hills, there is no clear trend over the long term (Figure 27).

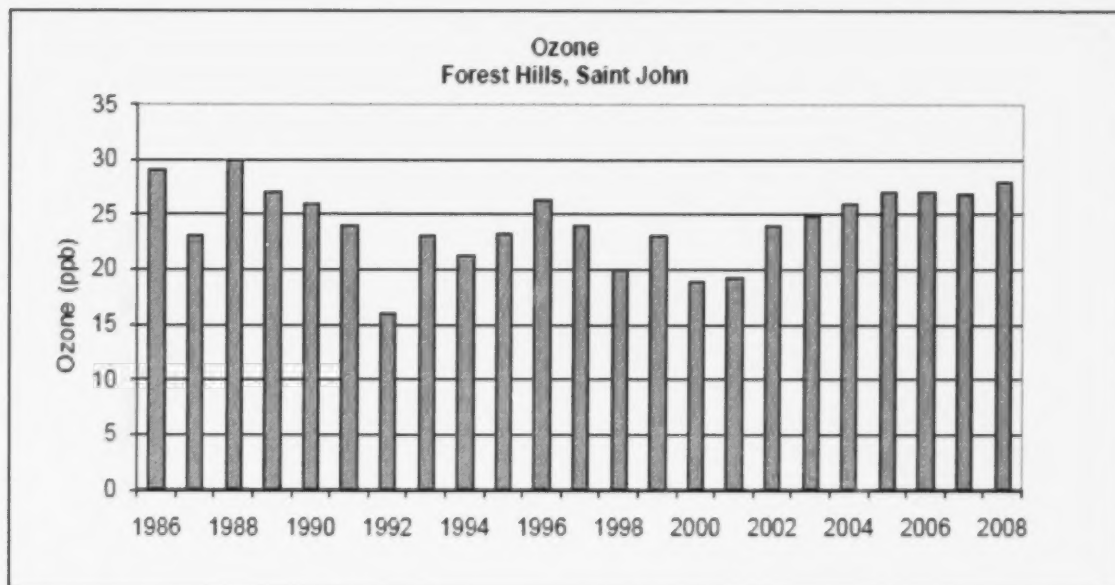


Figure 26. Annual mean ozone, Forest Hills, Saint John, 1986-2008.

Point Lepreau

Data for this site are included to provide a perspective from a rural location which is almost always upwind of major sources of air pollutants in southern New Brunswick. Annual O_3 levels are usually somewhat higher than those seen in

the Saint John area (Figure 28). This is because urban sites typically have higher concentrations of pollutants that react with and remove O_3 , such as NO_2 .

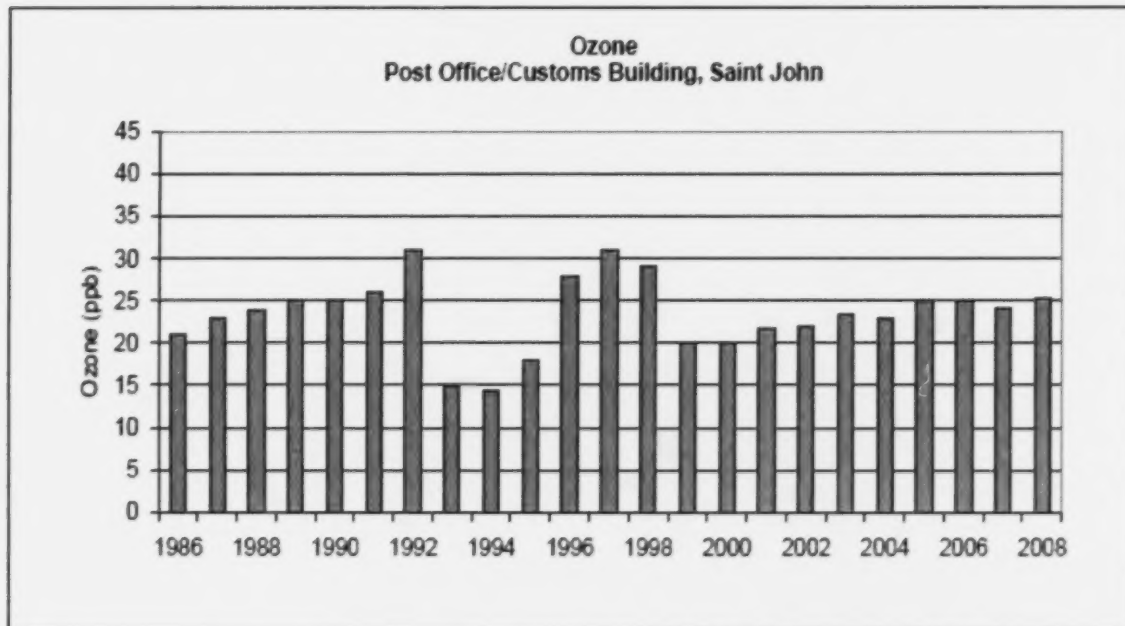


Figure 27. Annual mean ozone, Post Office/Customs Building, 1986-2008.

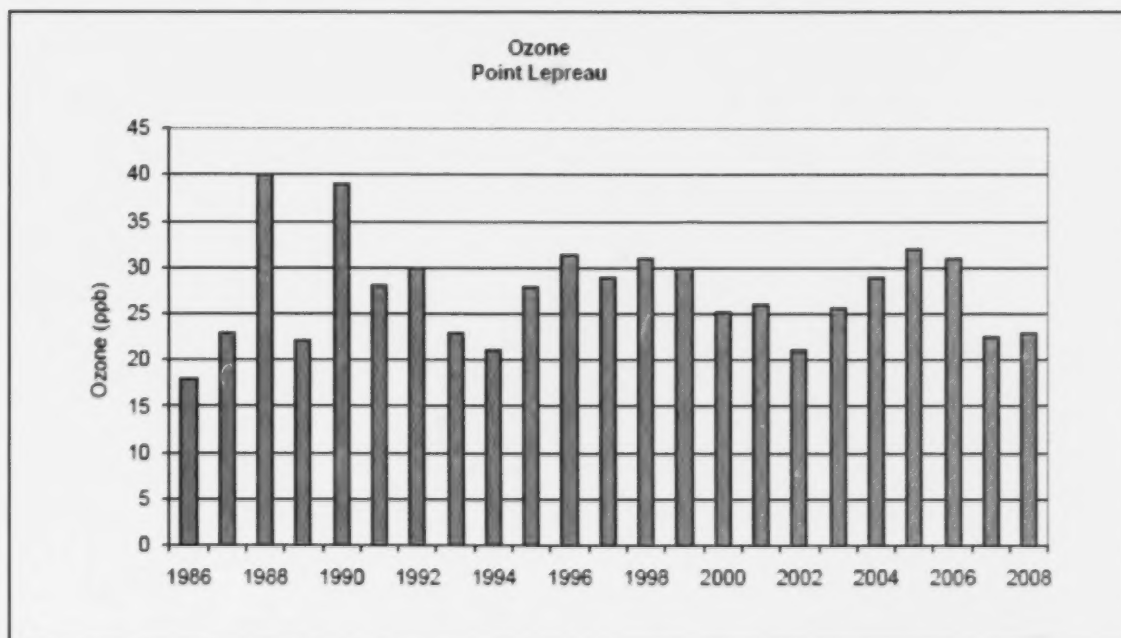


Figure 28. Annual mean ozone, Point Lepreau, 1986-2008.

Provincial Ozone Trends

Figure 29 shows a composite trend based on all O₃ sites in the province. The number of sites has increased substantially over the period of record, from three initially, to 14 in 2008. The latter half of the record is therefore more meaningful.

Examining the record since 1986, a linear trend line indicates no change in the province-wide O₃ average.

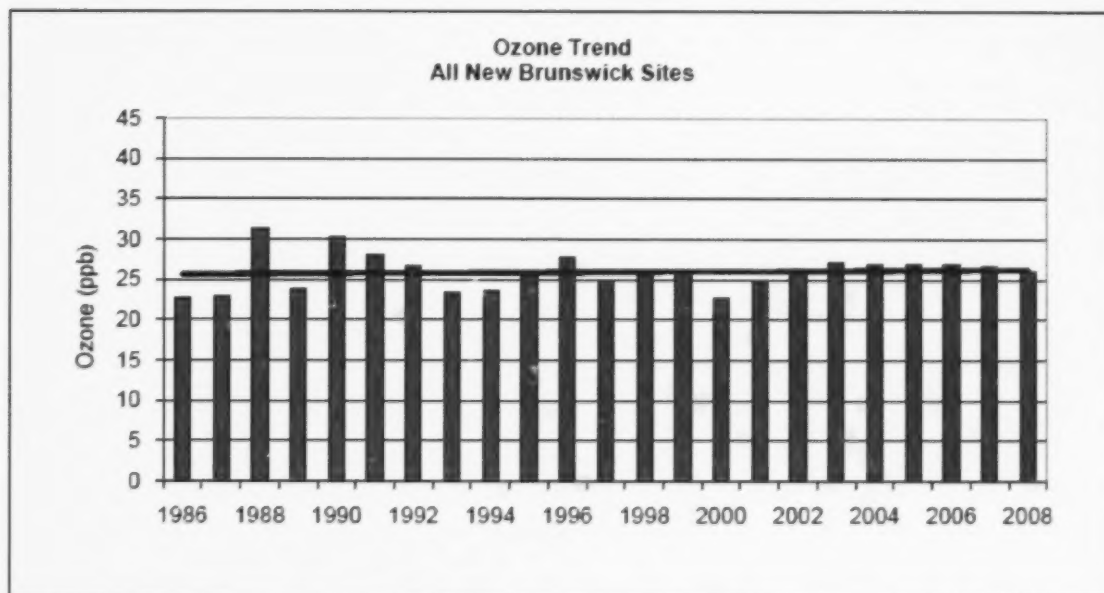


Figure 29. Trend in ozone, composite average of all New Brunswick sites, 1986-2008.

E. Volatile Organic Compounds

VOCs have been measured at two locations (Forest Hills and Point Lepreau) since 1992, as noted in section 3. Routine analyses provide results for over 150 VOCs. In July 2000, sampling began at Champlain Heights School, a site within 0.5 kilometers of the Irving Oil refinery complex in east Saint John. Trends for selected VOCs are presented in this section.

One clear finding from the VOC sampling program is that concentrations of most VOCs are substantially higher at Forest Hills and Champlain Heights than at Point Lepreau. This is consistent with the location of Forest Hills and Champlain Heights in an industrial/urban setting and Point Lepreau in a relatively remote, rural setting.

Figure 30 shows trends in average total VOC concentrations for all sites since 1992.

These results clearly show differences in average VOC levels between the three sites. There has been relatively little change at Point

Lepreau. At Forest Hills, annual average total VOC concentration continued to decline in 2008 as it has since 2005. At Champlain Heights, the proximity of that site to the refinery complex is reflected in higher and more variable total VOC concentrations. A decrease in total VOC concentration after 2005 was offset by an increase at that site by about 35% between 2007 and 2008. VOC monitoring will continue at these sites to further assess long term trends.

Compounds such as butane and isopentane (Figure 31), which are major components of gasoline vapour, generally reflected the total VOC trend at the two Saint John sites.

Some potentially toxic VOCs decreased from the early to the late 1990s, and have been more variable since then. Figure 32 shows the trend for benzene, Figure 33 for butadiene and Figure 34 for xylenes.

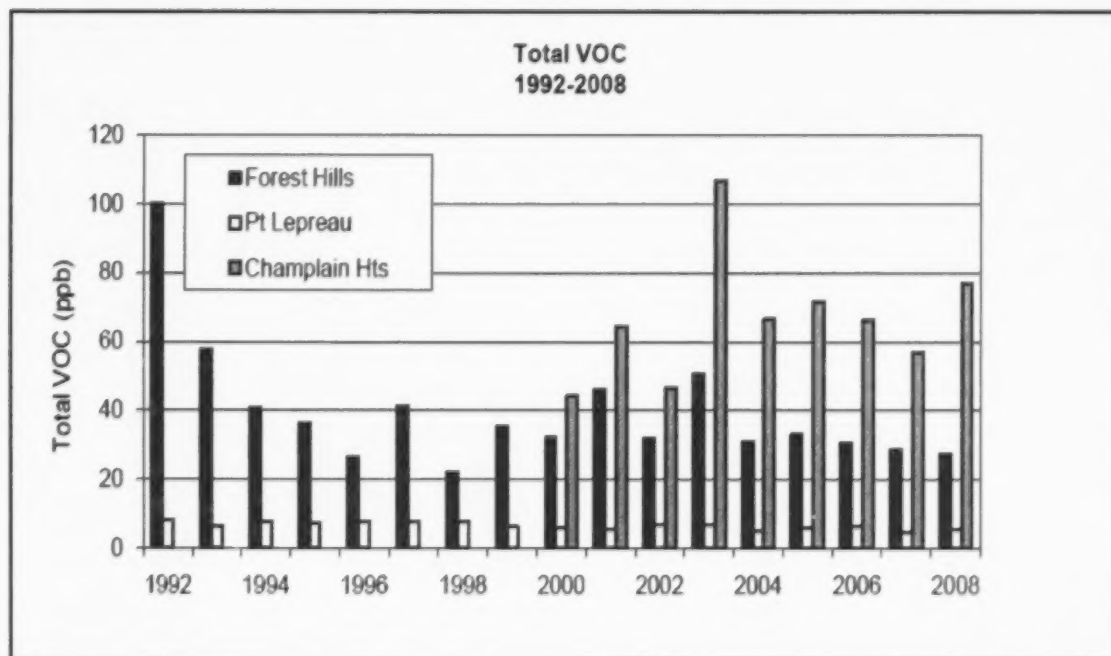


Figure 30. Average total VOC concentration at provincial VOC monitoring sites, 1992-2008.

Benzene is an important component of gasoline. Benzene levels have not changed appreciably in the past 3 years at Champlain Heights. However a decrease in annual average concentrations is apparent over the same time period and the longer term at Forest Hills and Point Lepreau.

Xylenes are associated with vehicle exhaust (Multistakeholder NOx/VOC Science Program, 1997a). As with benzene, a decreasing long term trend is apparent for xylenes at the Forest Hills site. The Champlain Heights' trend suggests little change over a shorter time frame.

Butadiene is emitted during petroleum refining and subsequent handling, as well as from internal combustion engines (e.g. CARB, 1992). Butadiene concentrations appear similar at both urban sites and some improvement is apparent since 2000.



Figure 31. Annual average concentration of butane plus isopentane at provincial VOC monitoring sites, 1992-2008.

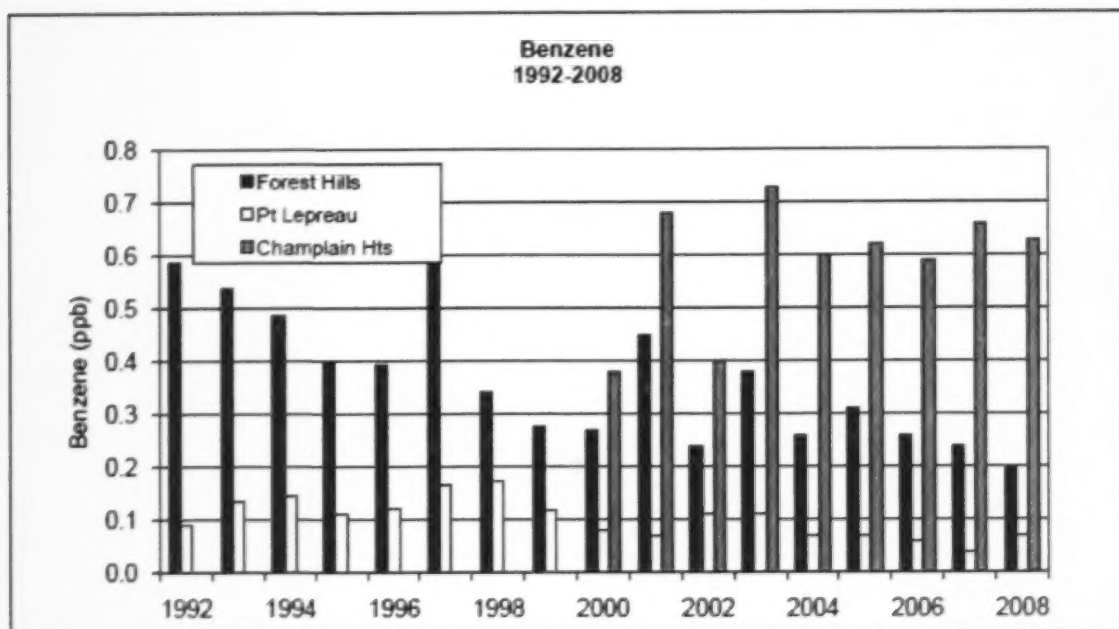


Figure 32. Annual average concentration of benzene at provincial VOC monitoring sites, 1992-2008.

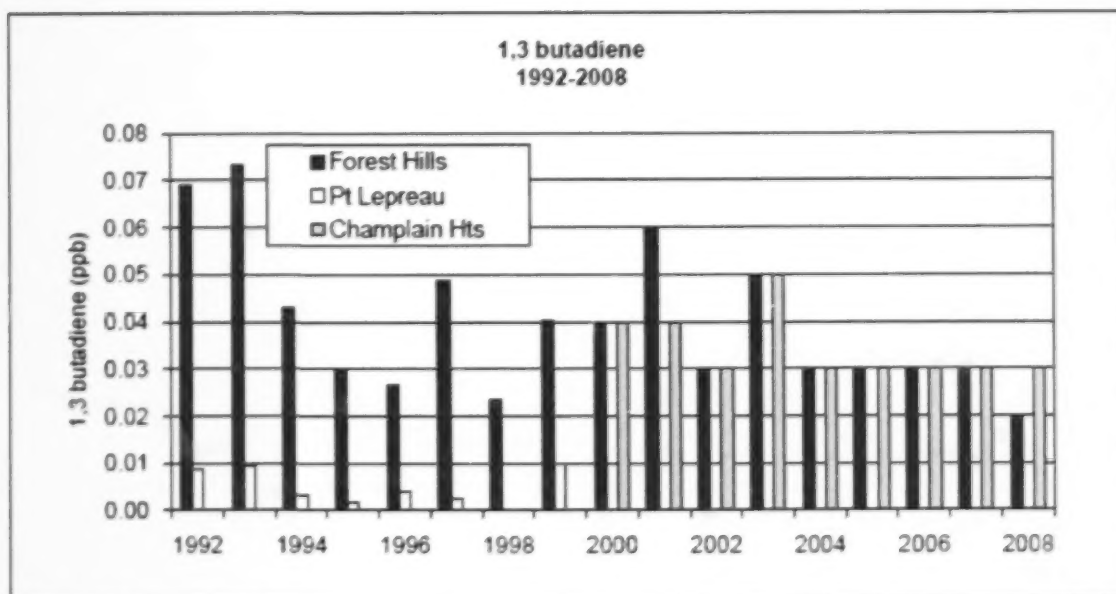


Figure 33. Annual average concentration of 1,3 butadiene at provincial VOC monitoring sites, 1992-2008.

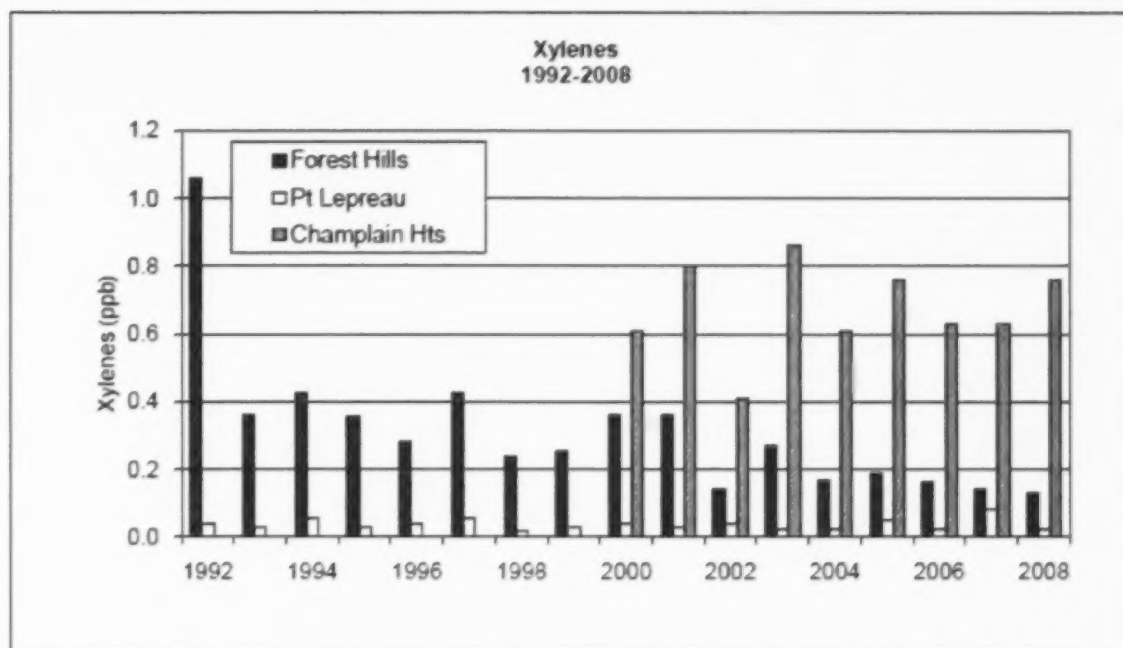


Figure 34. Annual average concentration of xylenes at provincial VOC monitoring sites, 1992-2008.

In Table 23, additional background information is provided on VOCs that are of special concern. These compounds are found on the "priority lists" of many nations, states and provinces, for special attention in term of control programs, including actions such as minimising use, emissions, and human exposure.

It is apparent that a lot of these compounds have features in common. Many are found in crude oil or are produced as part of the petroleum refining process and they are often used as solvents, or in paint or plastics. Combustion of other fuels (i.e. wood burning) is also a potential source of many of these VOCs. Although these compounds have been identified for priority attention, in many cases there is still relatively little information available

on their toxicity. In such cases they are often not classifiable in terms of cancer-causing potential, and sufficient detail may not be available to determine if ambient air quality guidelines should be established. For many of the VOCs in this list, technical data sheets note that they may affect the nervous system. In cases where this is known from clinical trials or actual human exposure, it is usually at very high concentrations, much greater than what would be found in the outdoor environment.

Table 23. Additional information on VOCs of special concern.

	Cancer-causing	Sources	Other details
1,3 butadiene	Yes (OSHA)	Refining, gasoline, plastics industry, rubber manufacturing, burning.	Most is used to make synthetic rubber.
Benzene	Yes (OSHA, IARC, EPA). Linked with leukaemia.	Refining, gasoline, burning, coal coking.	High-volume industrial compound.
Toluene	No, or unclassifiable (EPA)	Refining, gasoline, solvents.	High levels can affect the nervous system.
Ethylbenzene	No, or unclassifiable (EPA)	Petroleum products, adhesives, paint.	Limited health impact information available.
Xylenes	Insufficient information to classify (EPA, IARC)	Solvents, printing, paint, vehicle exhaust.	High levels can affect the nervous system.
Styrene	Possibly (IARC)	Plastics industry.	High-volume substance used in many products containing plastic or insulation.
Chloromethane	Possibly (EPA)	Burning, natural sources, swimming pools.	High levels can injure the nervous system.
Vinyl chloride	Yes (OSHA). Linked to cancer of liver, brain and lung.	Plastics industry.	No natural sources. Used to make PVC.
1,1 dichloroethylene	Suspected (EPA)	Adhesives and packaging material manufacture.	High levels can cause liver and kidney damage.
Dichloromethane	Probable (EPA), "may cause cancer" (WHO)	Paint stripper, industrial solvent.	No natural sources.
1,2 dichloroethane	Potential (EPA)	Solvent use, plastics and textiles manufacture.	Can cause nervous system disorders and adverse lung, liver and kidney effects.
Carbon tetrachloride	Possibly (IARC), probable (EPA)	Most uses banned. Formerly widely used as a solvent, propellant, and fire extinguishing agent.	No natural sources. Stable from 30-100 years in the atmosphere.
1,2 dichloropropane	Not classifiable (IARC)	Relatively few uses. Chemical intermediate for making other compounds.	No natural sources. High levels may cause organ failure or lung damage.
Trichloroethylene	Probable (IARC)	Paint, solvent use.	No natural sources but persistent in the environment, especially in soils and groundwater.
1,1,2 trichloroethane	Not classifiable (IARC)	Solvent use, and used as a chemical intermediate.	Persistent in groundwater; breaks down slowly in air.
Ethylene dibromide	Potential (EPA)	Pesticide and solvent use. Dye manufacture.	Known to affect the liver, stomach and testes.
Tetrachloroethylene	"May be reasonably anticipated to be" (DHHS)	Dry cleaning, metal degreasing.	High concentrations affect the nervous system.
1,1,2,2, tetrachloroethane	Possible (EPA)	Chemical intermediate.	No longer used as an end product. Previously used as a solvent and in pesticides.
Formaldehyde	Yes (OSHA)	Used in plastics resins, plywood, paper and fertilizers.	Also found in photochemical smog. Can irritate eyes, nose and throat.
Acetaldehyde	Probable (EPA, IARC)	Acetic acid manufacture.	Many uses including as a food additive.
MTBE	Not classified by IARC, EPA or DHHS	Gasoline additive.	Characteristic turpentine-like smell. Contaminates and persists in groundwater.

Notes: EPA = United States Environmental Protection Agency; IARC = International Agency for Research on Cancer; DHHS = US Department of Health and Human Services. Where sources are given, the list provides major examples but is not exhaustive. In most cases there will be additional sources.

9. QUALITY ASSURANCE

The provincial air quality network quality assurance program consists of a number of components, with input and responsibility from both DENV and Environment Canada. Sites managed by DENV are operated according to procedures and methods endorsed by the National Air Pollution Surveillance (NAPS) program, headquartered in Ottawa.

The objective of quality assurance procedures is to provide accurate, representative, comparable, high quality data using consistent operational protocols and standards. The NAPS agency provides calibration, reference standards, and technical support to DENV. Calibration gases are certified for accuracy and are either "primary reference standards" or are traceable to primary standards maintained by the National Institute of Standards and Technology (NIST) in Maryland.

Instrumentation technologies used in both the provincial and industry networks must satisfy the requirements of the United States Environmental Protection Agency (EPA) as equivalent or reference method for ambient air monitoring. Methods not yet certified by the EPA are used if approved and tested by the NAPS agency.

Quality assurance tasks in the operation of monitoring stations include regular site inspections, instrument response verifications and analyzer calibrations.

Air quality monitoring analysers are specialised instruments, requiring regular maintenance to ensure acceptable operation. In addition, calibration procedures are necessary to ensure accurate results are obtained. For instruments measuring pollutants in gas form, calibration involves introducing known concentrations of the pollutant gas to the analyser, and monitoring the response. Three or four concentration values are used when performing such a "multipoint" calibration. Certified flow, temperature and pressure standards are used for equipment which measures particulate matter.

Audits of sites operated by DENV are performed by Environment Canada on randomly selected sites within the provincial network. These audits are completed every two years to ensure acceptable data quality. An interlaboratory testing program is also conducted annually. This consists of the analysis of gases supplied "blind" (i.e. with no information on the true concentration) by the NAPS laboratory. DENV technicians analyze the blind test gas using their calibration equipment and send the results to NAPS, who return a report on performance to the province. This serves to standardize the performance of calibration systems within the province and across the country.

Industry network audits are performed by DENV every one or two years, using NAPS certified standards (see the following section).

After data have been acquired, they are all validated by DENV. This involves examining results, taking into account instrument records, especially "zero and span drift" (measures of internal instrument changes), other site records, maintenance procedures, calibration of the analyzers, adjustments made to operating settings, performance and history of the analyzers, seasonal conditions, and changes and levels of other pollutants during a given time frame.

Audits of Industry-Operated Sites

To ensure data quality, DENV technicians visit the monitoring sites operated by industries in New Brunswick, and perform independent site audits. It is normal to check all operating analysers at least once per year, or more often if required. Audits help identify and solve problems, prevent problems from developing, and assure data quality within the provincial monitoring system.

Results of air quality monitoring audits in 2008 are summarised in Table 24. A total of 30 instrument audits were carried out in 2008. Figure 35 illustrates audit results from 1998 to 2008. As shown, there has been substantial improvement in the amount of failed audits over this time period.

Table 24. Air quality site audits, 2008.

Industry	Site	Instrument	Date	Absolute Difference From Standard (%)	Pass/Fail
A/V cell Inc.	Boom rd.	SO2	19-Nov-08	7.5	P
	Beauvista	SO2	19-Nov-08	3.5	P
Fraser Inc/Nexor	Cormier School	SO2	18-Nov-08	1.0	P
		TEOM - PM2.5	18-Nov-08	3.0	P
	St-Mary's	SO2	18-Nov-08	1.0	P
A/V Nackawic Inc.	Caverhill Road	TRS	23-Jun-08	9.4	P
		SO2	23-Jun-08	2.5	P
Irving Oil Limited	Forest Products	SO2	26-May-08	2.3	P
	Grandview West 2	NOX	18-Apr-08	10.0	P
	Midwood Ave	SO2	27-May-08	3.3	P
NB Power Millbank	Rockcliff	NOX	27-Oct-08	2.7	P
		SO2	27-Oct-08	2.7	P
NB Power Dalhousie	Pointe La Nim	SO2	13-May-08	6.4	P
	Pointe a la Garde	SO2	14-May-08	3.3	P
	Mobile	SO2	13-May-08	5.6	P
	Bayview	SO2	14-May-08	0.5	P
	Coal Berm	SO2	13-May-08	12.8	P
NB Power Belldune	Municipal site	NOX	28-Oct-08	2.0	P
		SO2	28-Oct-08	2.4	P
	Belldune East	NOX	28-Oct-08	2.5	P
		SO2	28-Oct-08	3.8	P
NB Power Grand Lake	Flowers Cove	SO2	30-Apr-08	1.2	P
	Newcastle Centre	SO2	30-Apr-08	3.0	P
	Bailey's Point	SO2	30-Apr-08	0.6	P
NB Power Coleson Cove	Manawagonish Rd.	SO2	28-May-08	2.0	P
		BAM 1020 - PM2.5	28-May-08	2.4	P
	Lorneville	SO2	29-May-08	0.6	P
		BAM 1020 - PM2.5	29-May-08	5.3	P
Brunswick Smelter	Chalmers site	SO2	29-Oct-08	2.0	P
	Town Site	SO2	29-Oct-08	1.0	P

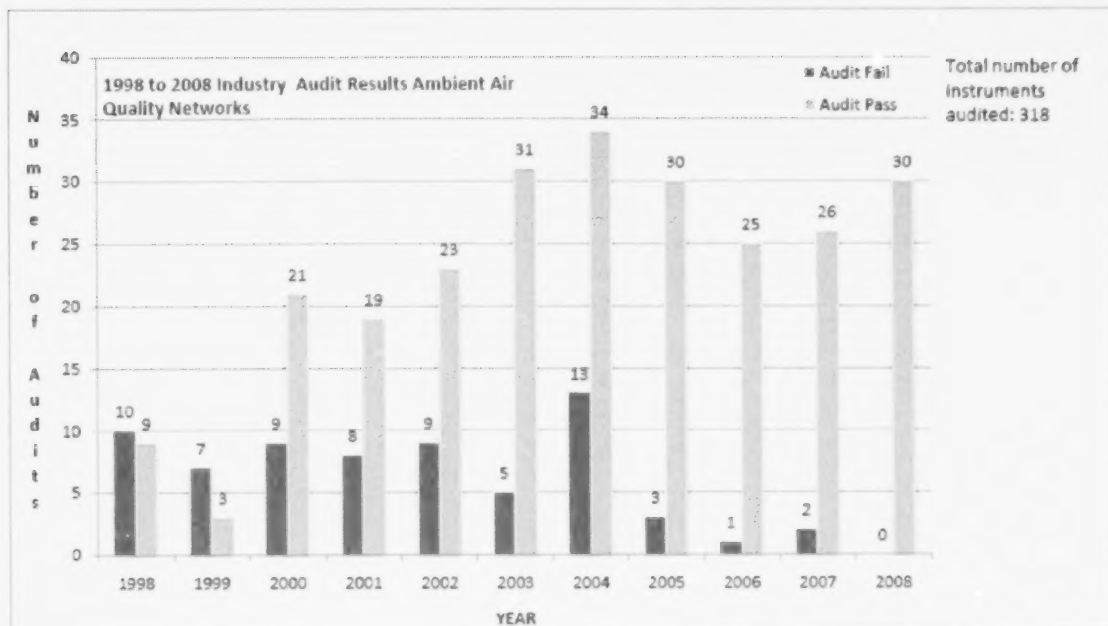
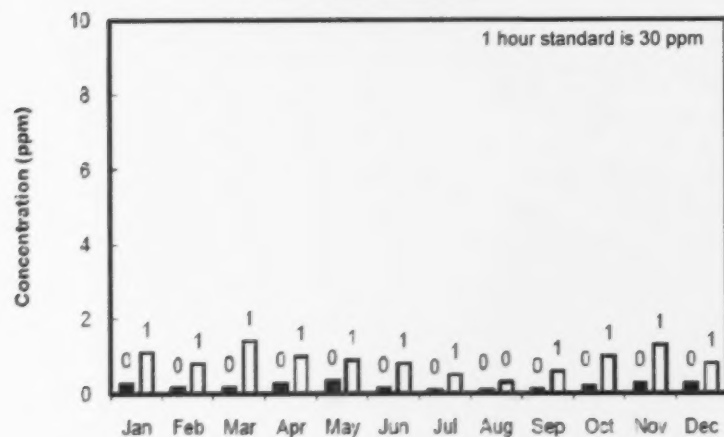


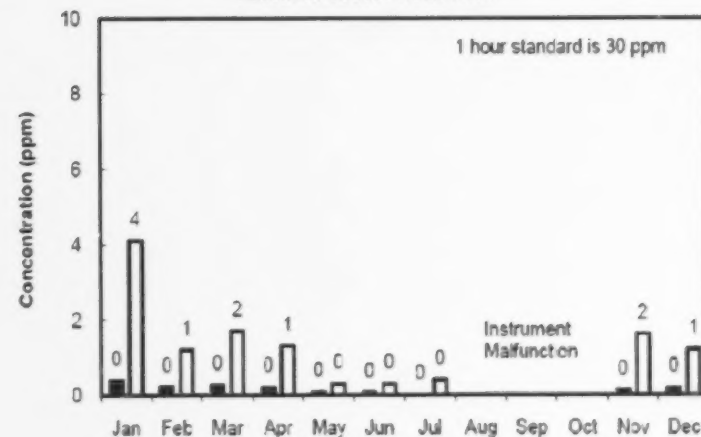
Figure 35. Industry Audits Passed and Failed for the years of 1998-2008.

**APPENDIX 1:
DETAILED MONTHLY MONITORING
RESULTS FOR 2008**

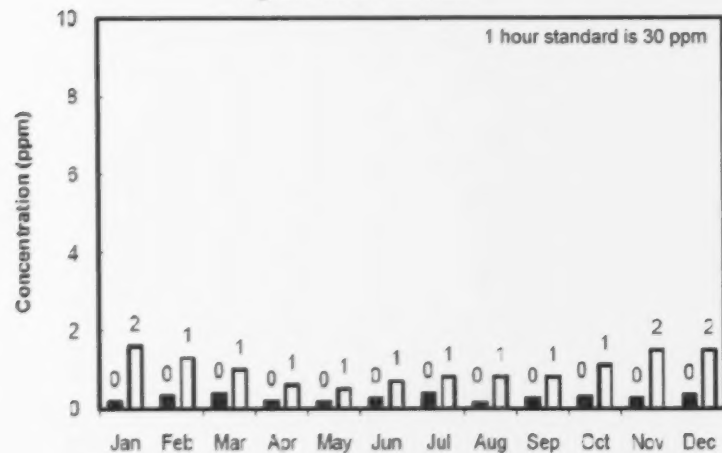
Monthly average and maximum 1 hour values of Carbon Monoxide in 2008
Customs Building-Saint John



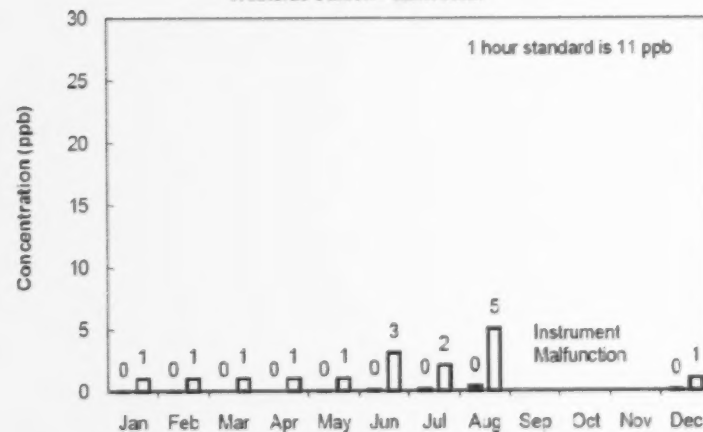
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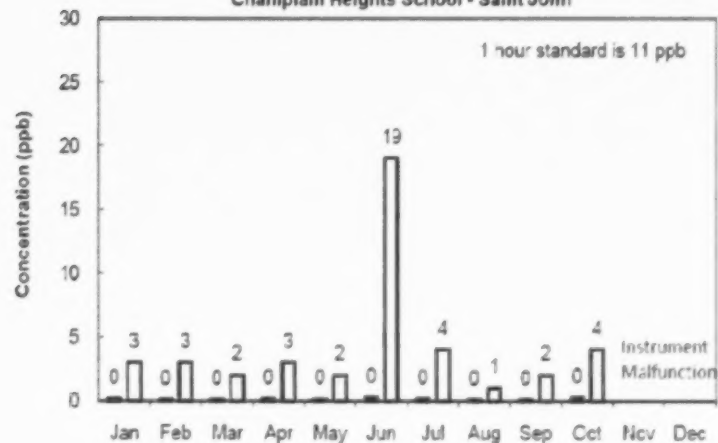
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Highfield Street - Moncton



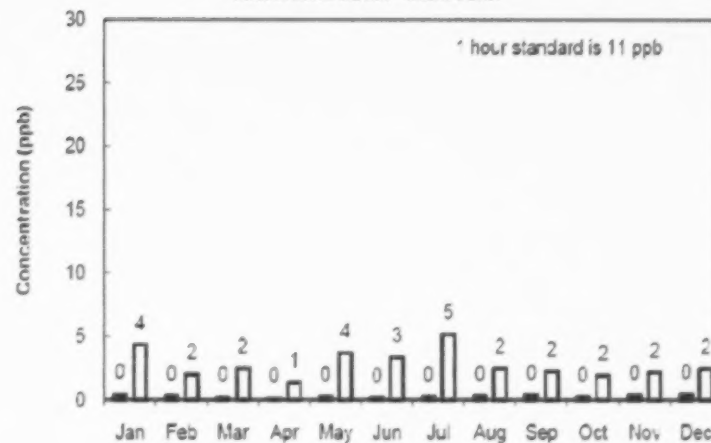
Monthly Average and Maximum One-Hour Values of TRS in 2008
Westside Station - Saint John



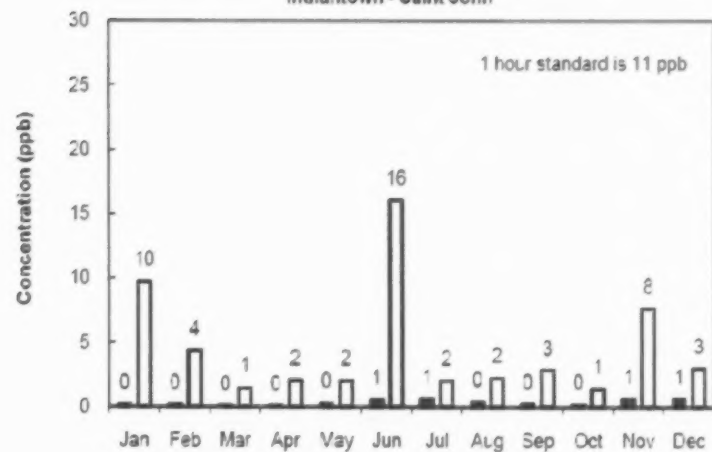
Monthly Average and Maximum One Hour Values of TRS in 2008
Champlain Heights School - Saint John



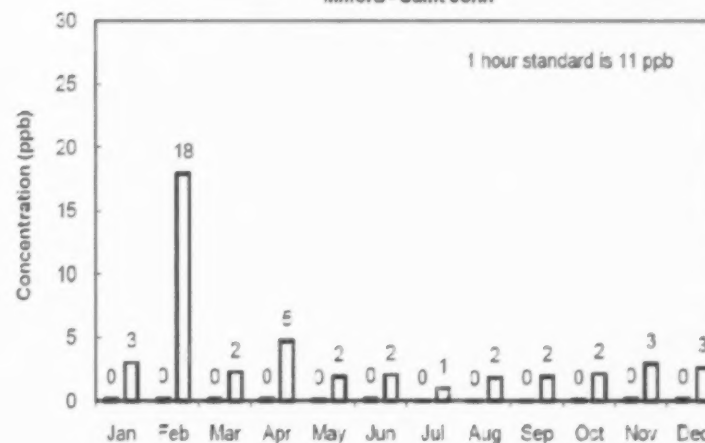
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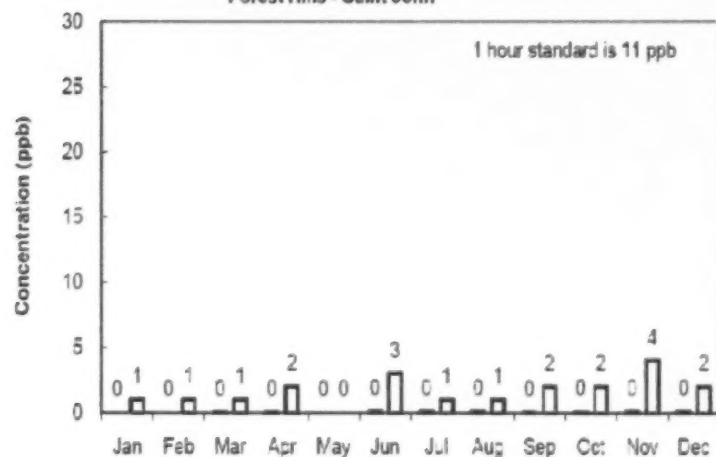
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Indiantown - Saint John



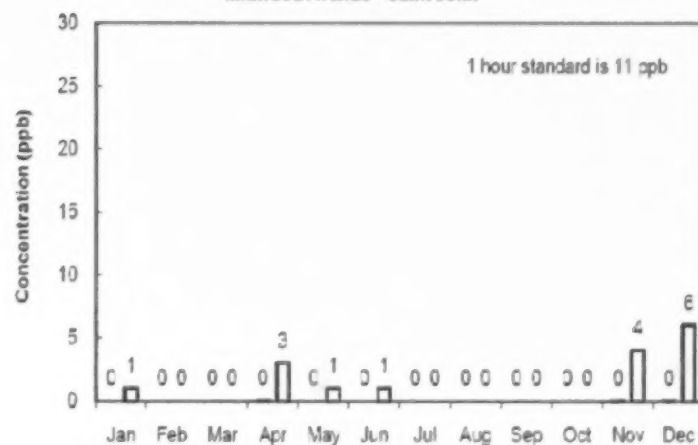
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Milford - Saint John



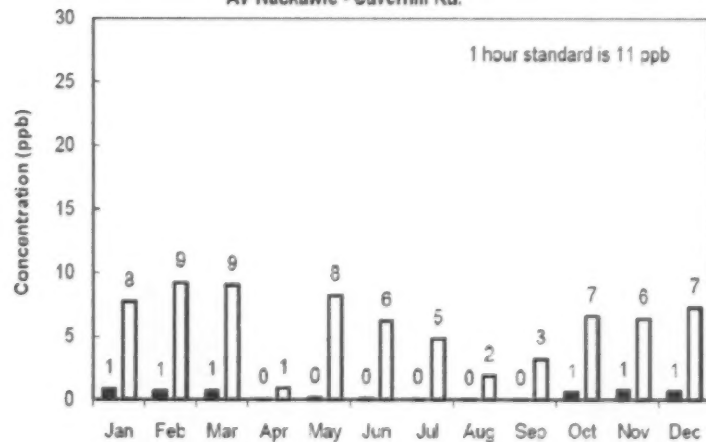
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Forest Hills - Saint John



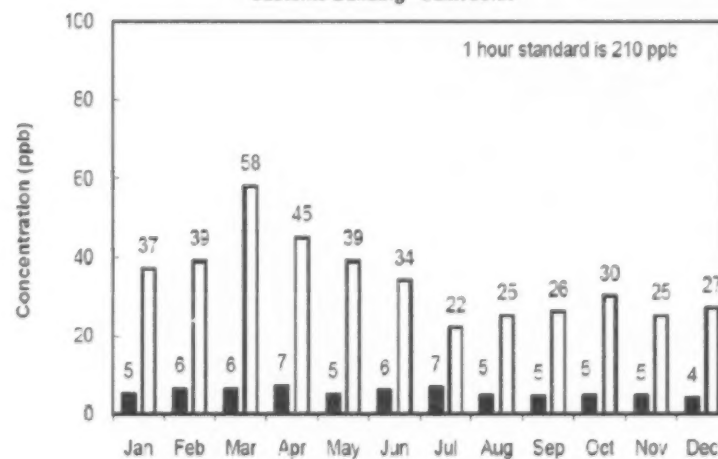
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Midwood Avenue - Saint John



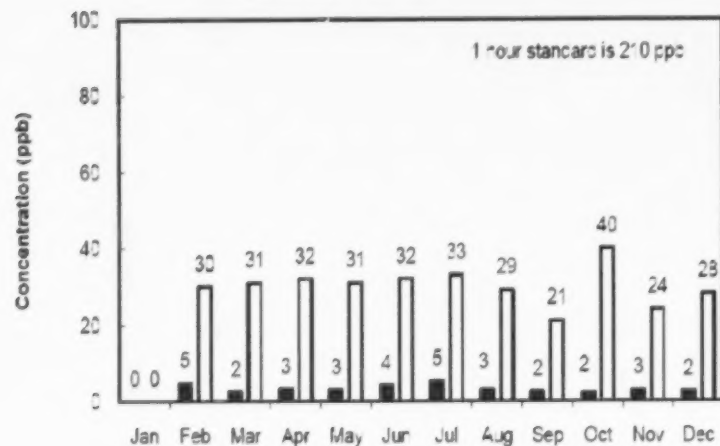
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AV Nackawic - Caverhill Rd.



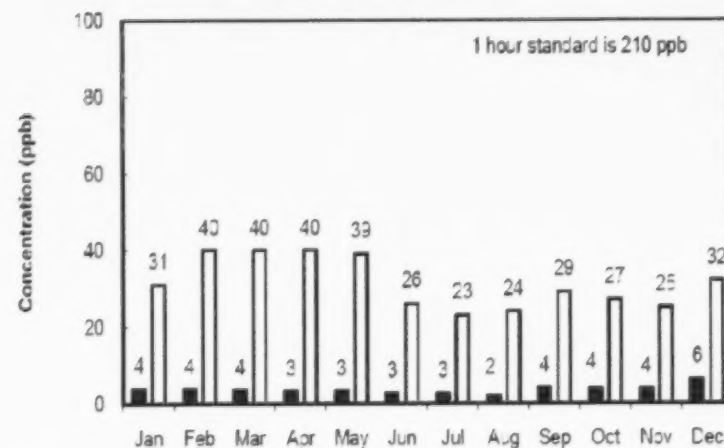
Monthly Average and Maximum One Hour Values of Nitrogen Dioxide in 2008
Customs Building - Saint John



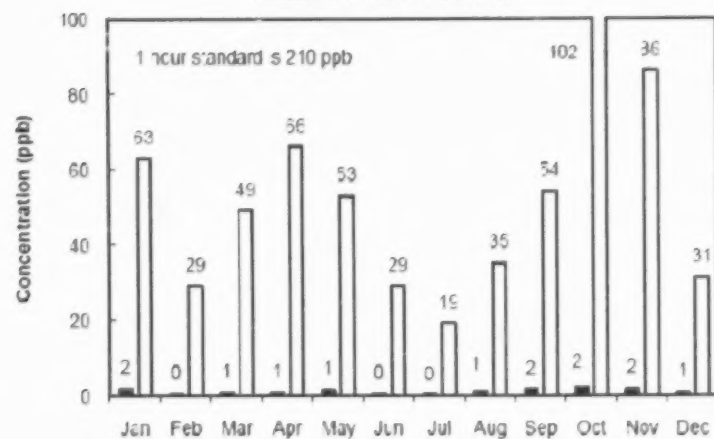
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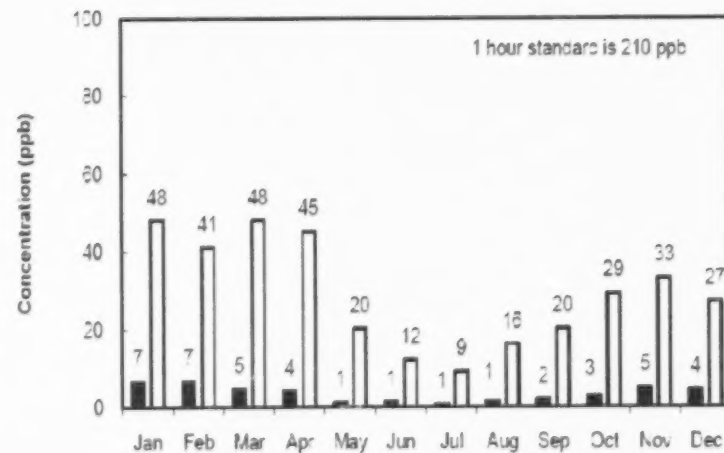
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Champlain Heights - Saint John



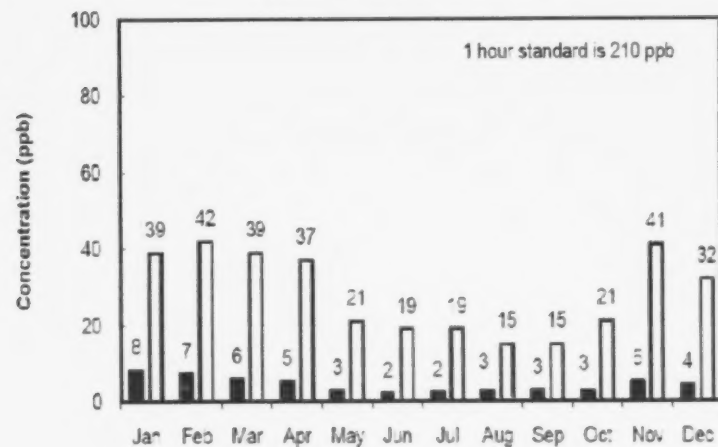
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Grandview West: 2 - Saint John



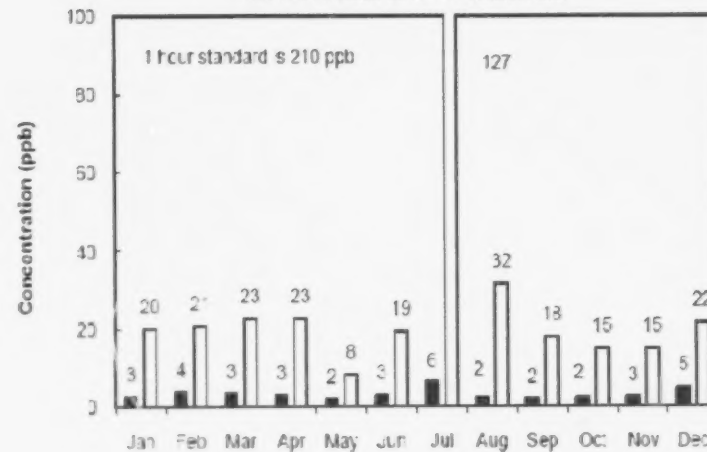
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Aberdeen Street - Fredericton



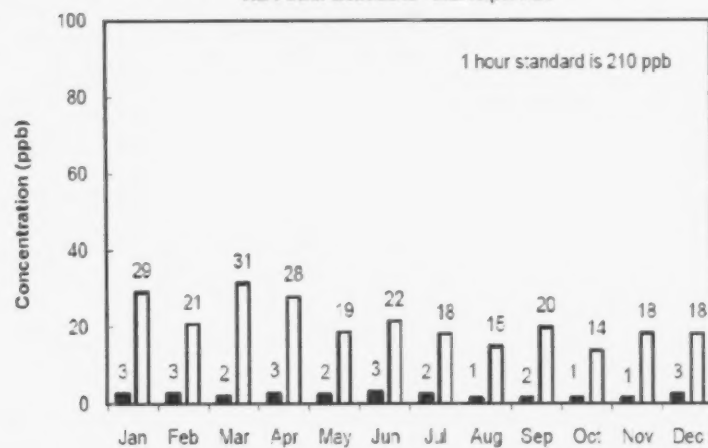
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Highfield Street - Moncton



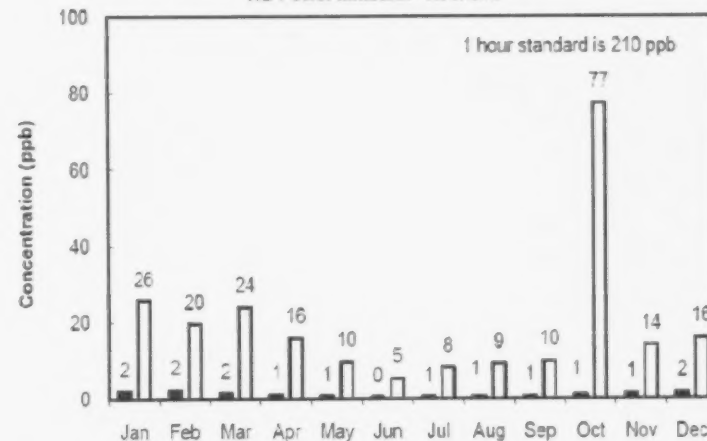
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NB Power Belledune - Belledune East



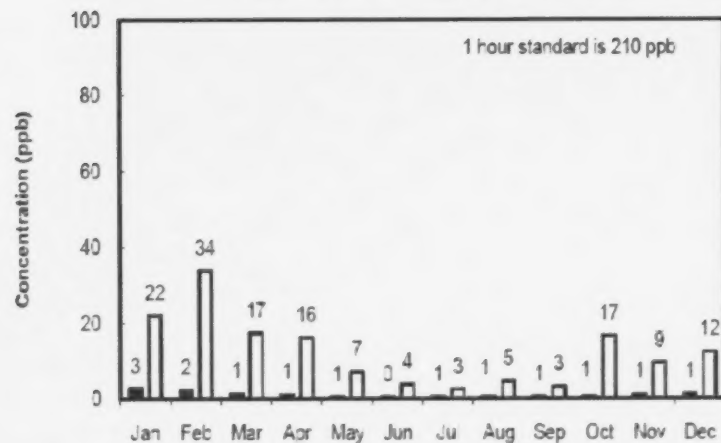
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NB Power Belledune - Municipal Hall



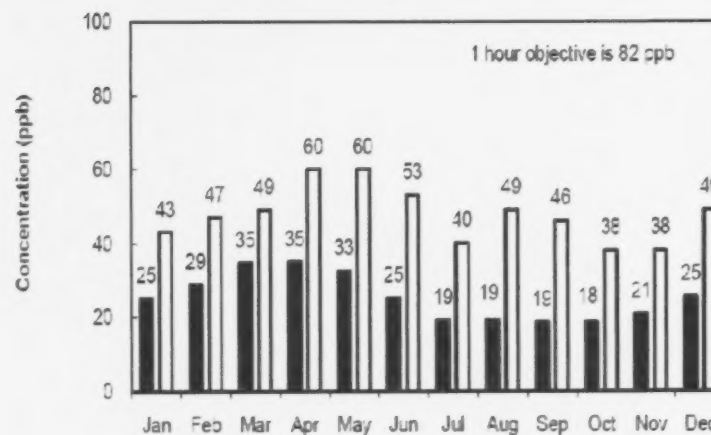
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NB Power Millbank - Rockcliff



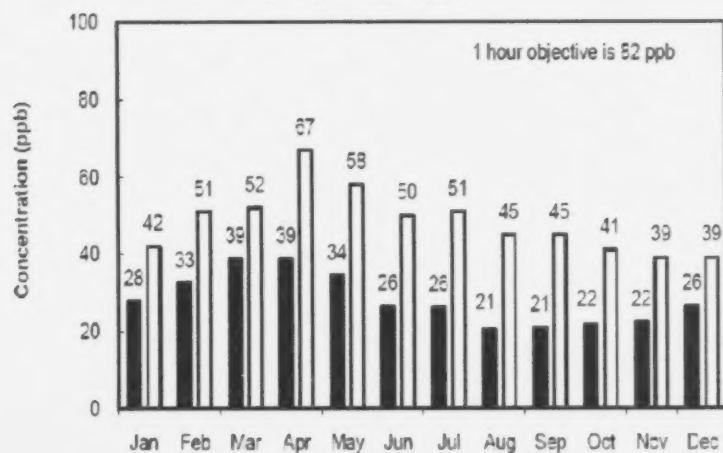
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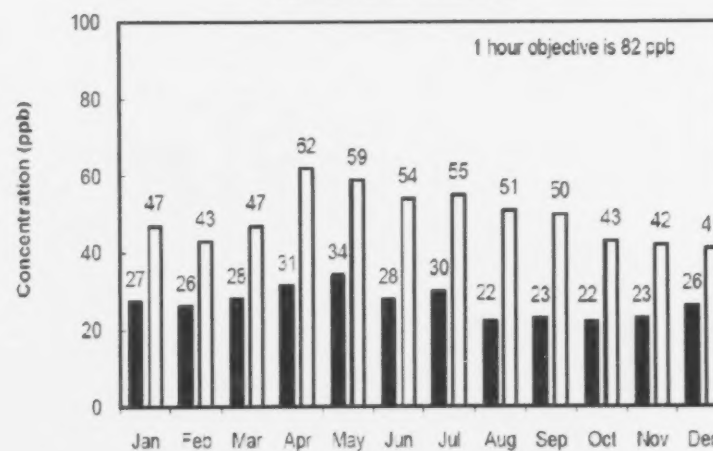
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Customs Building - Saint John



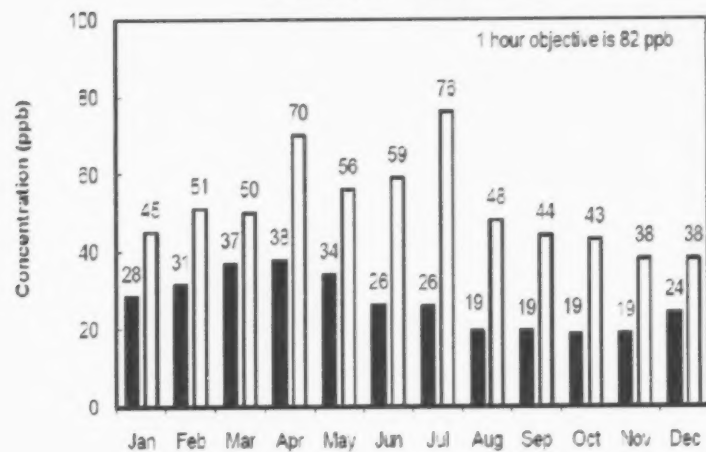
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Forest Hills - Saint John



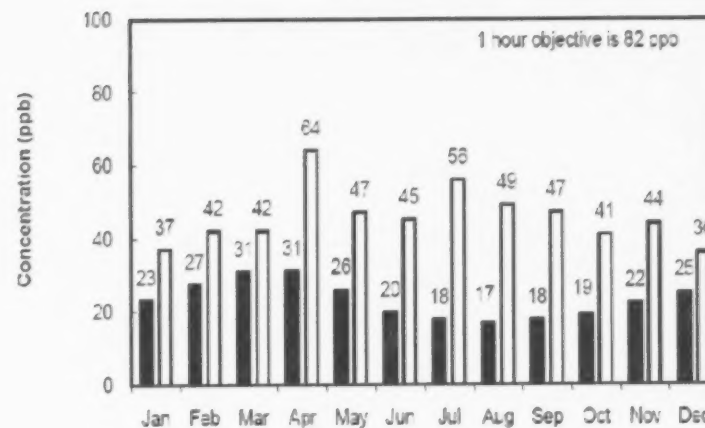
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Westside Station - Saint John



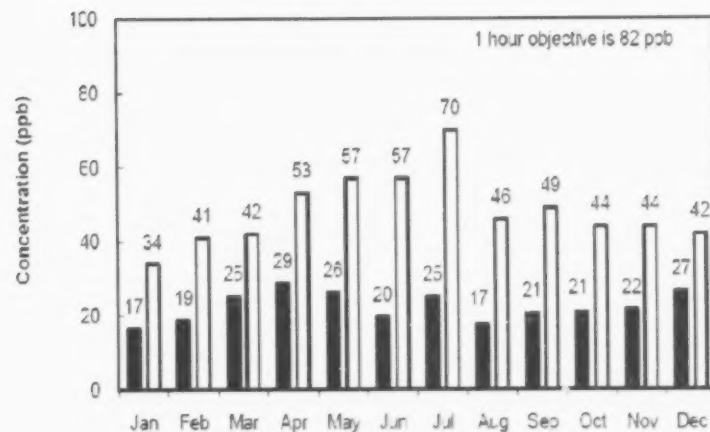
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Aberdeen Street - Fredericton



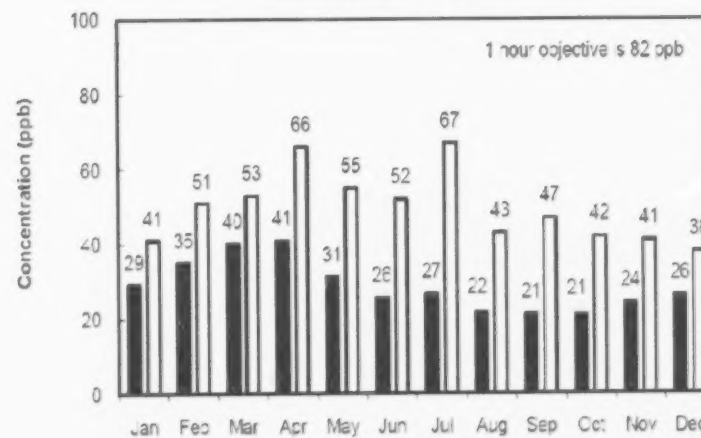
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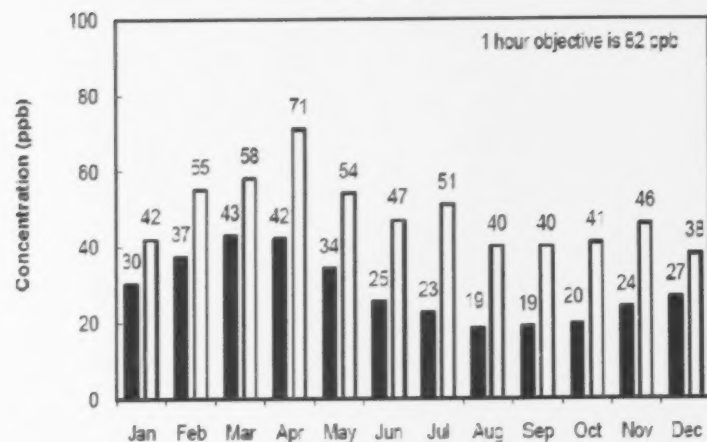
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Highfield Street - Moncton



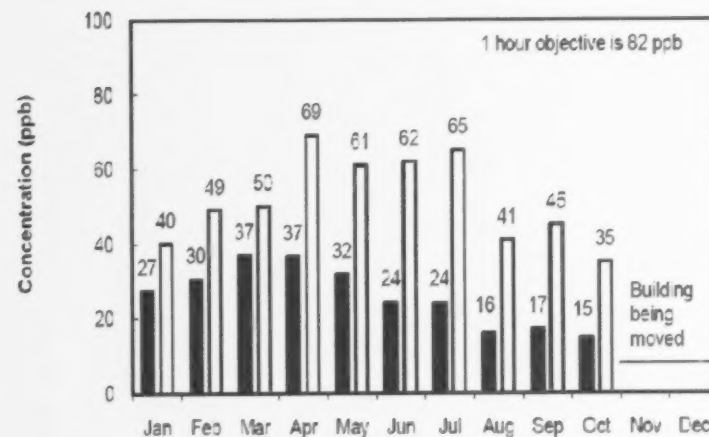
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Lower Newcastle - Miramichi



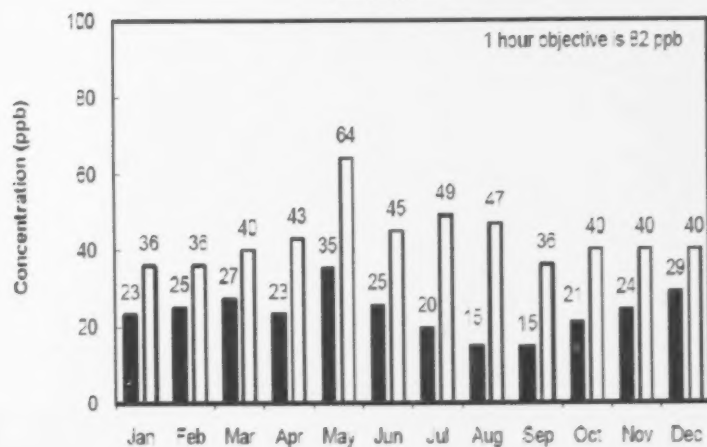
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St. Leonard



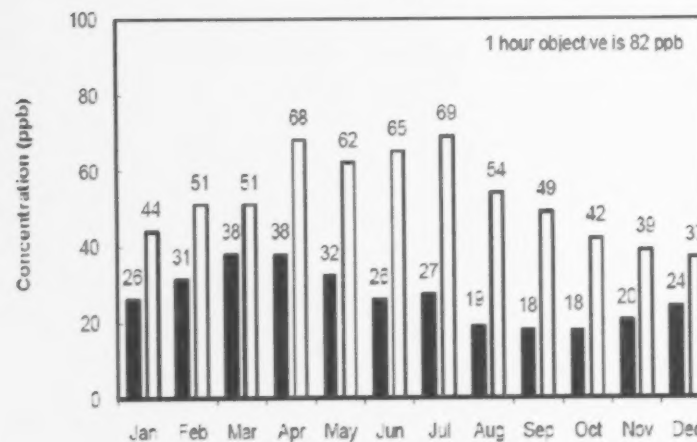
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Blissville



Monthly Average and Maximum One Hour Values of Ozone in 2008
Point Lepreau

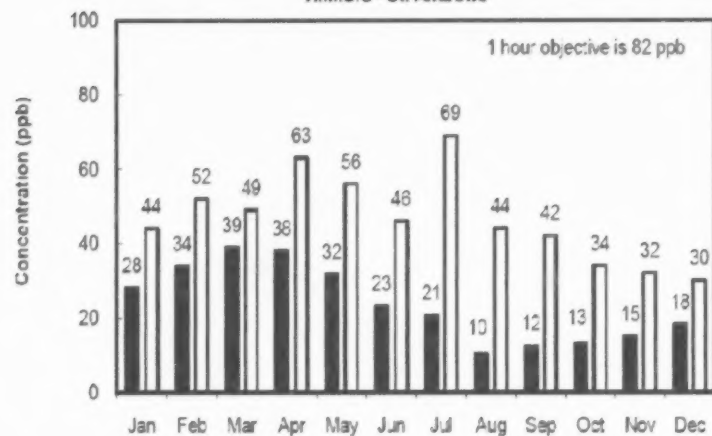


Monthly Average and Maximum One Hour Values of Ozone in 2008
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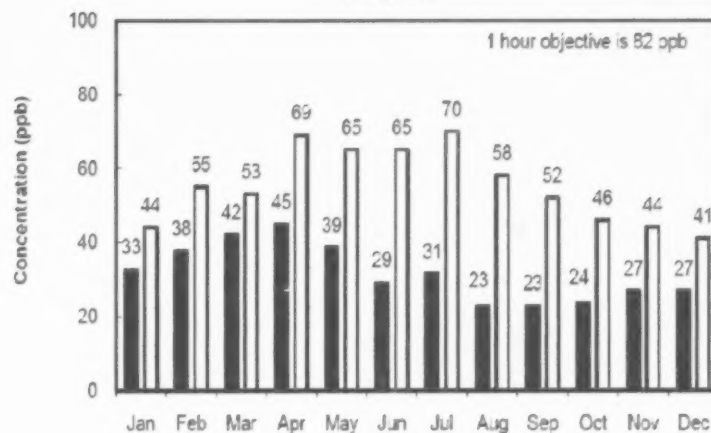
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H.M.S.C - St. Andrews



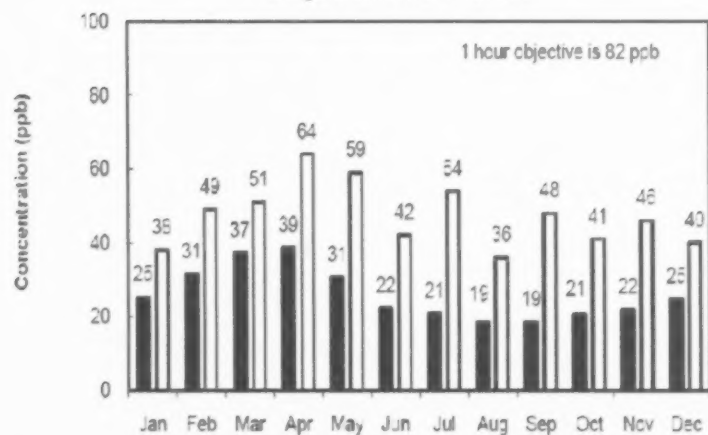
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Fundy Park



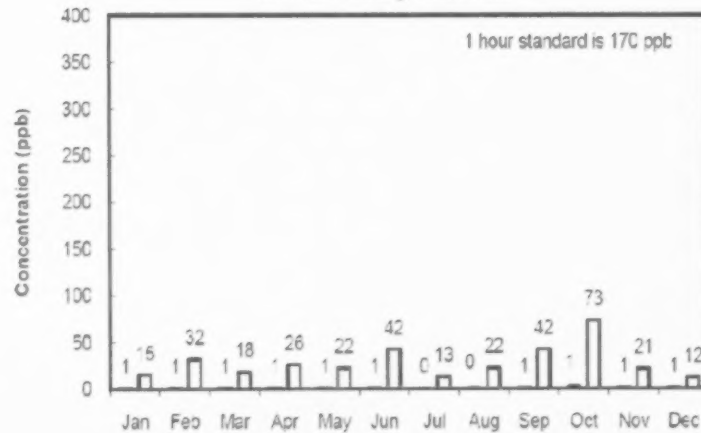
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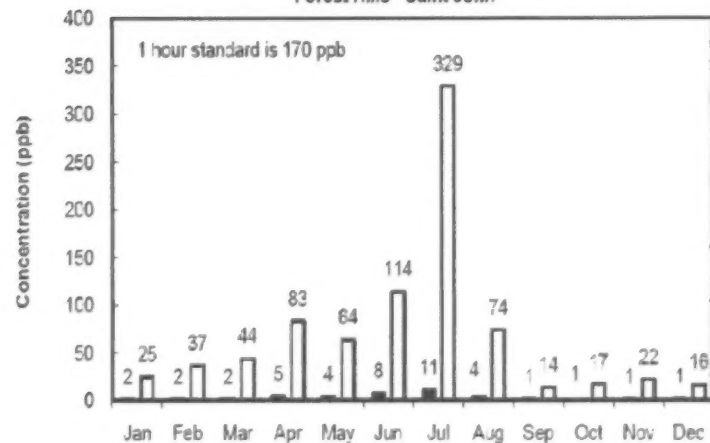


Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008

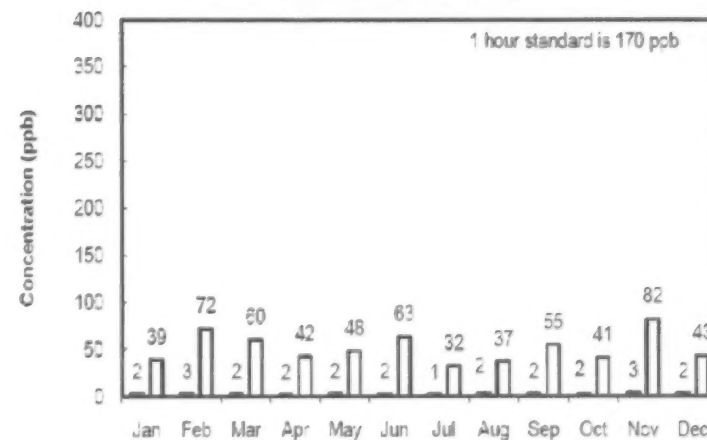
Customs Building - Saint John



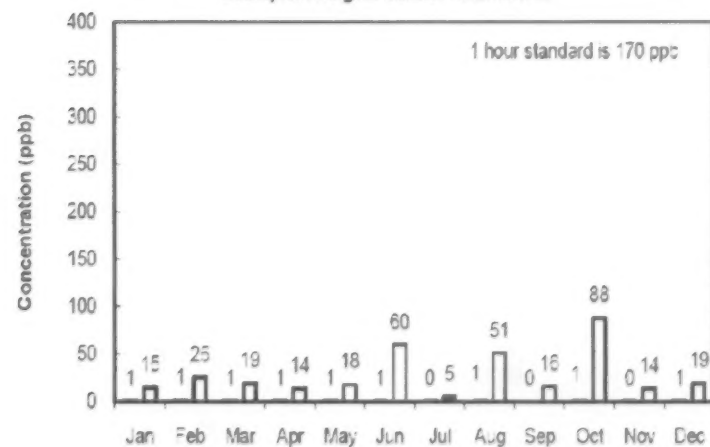
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Forest Hills - Saint John



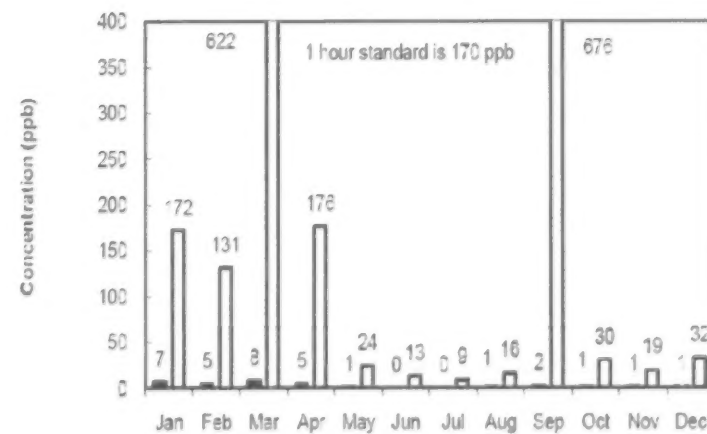
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Westside Station - Saint John



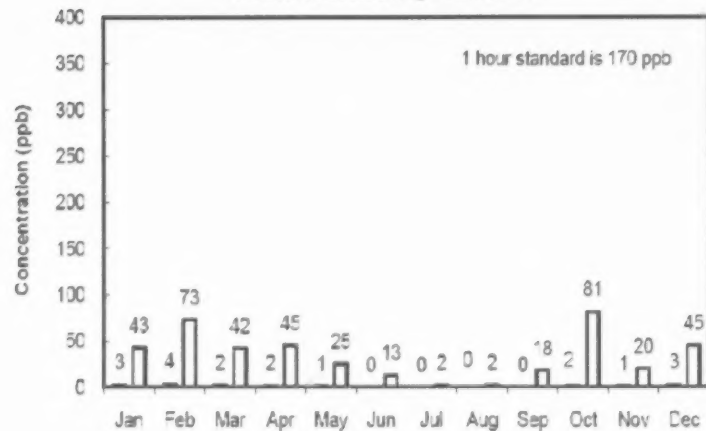
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Champlain Heights School - Saint John



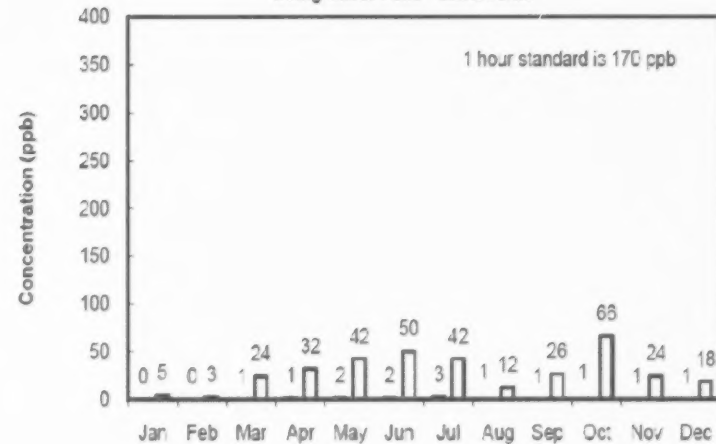
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Grandview West 1 - Saint John



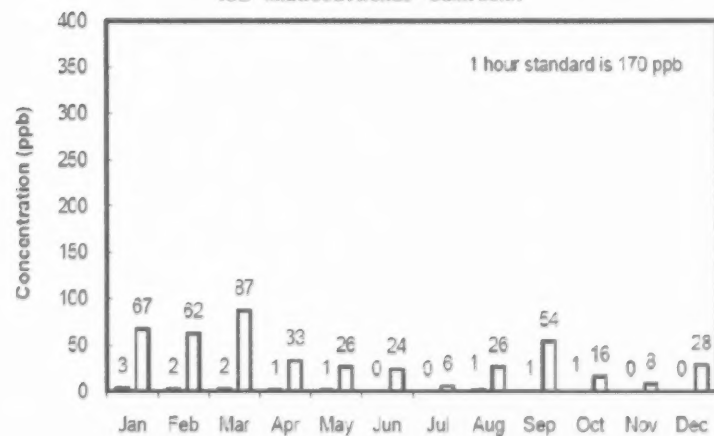
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Forest Products Irving - Saint John



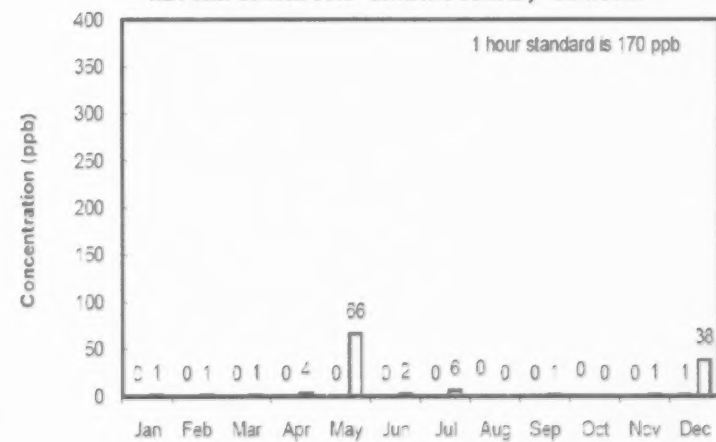
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Irving Silver Falls - Saint John



Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
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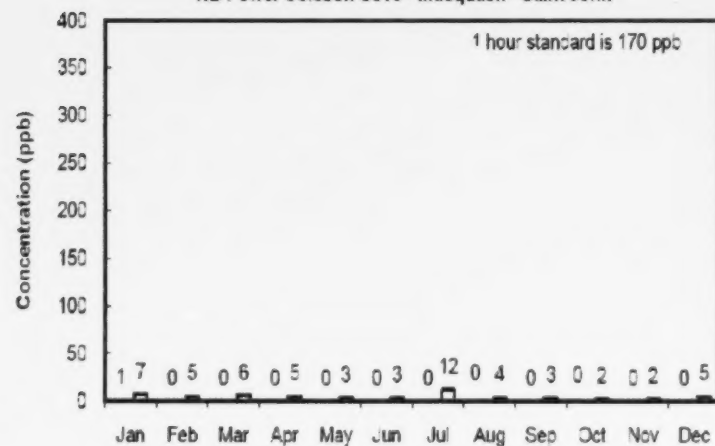


Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
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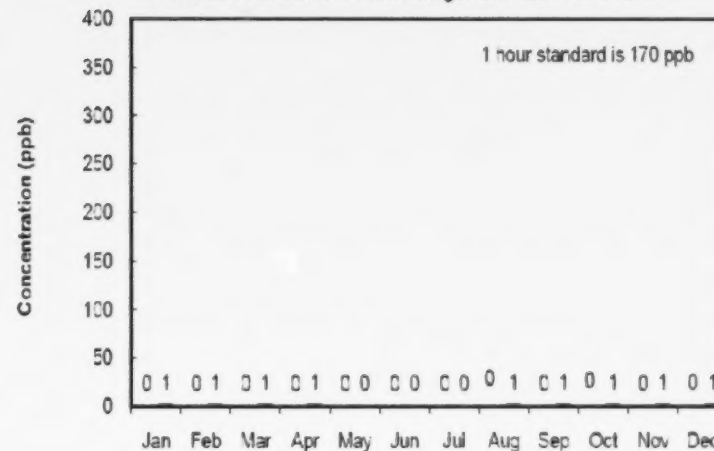
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NB Power Coleson Cove - Musquash - Saint John



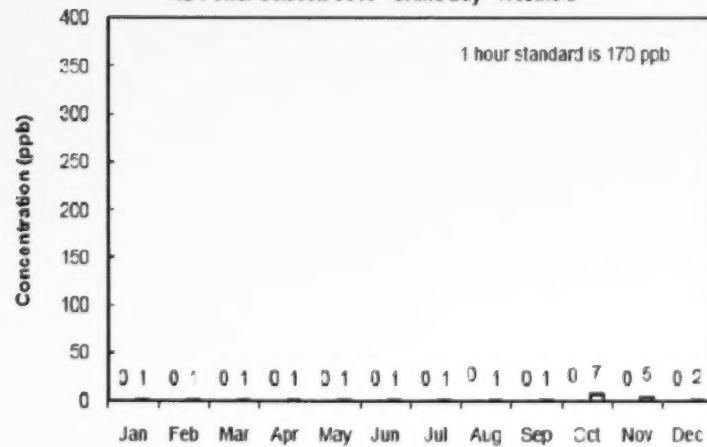
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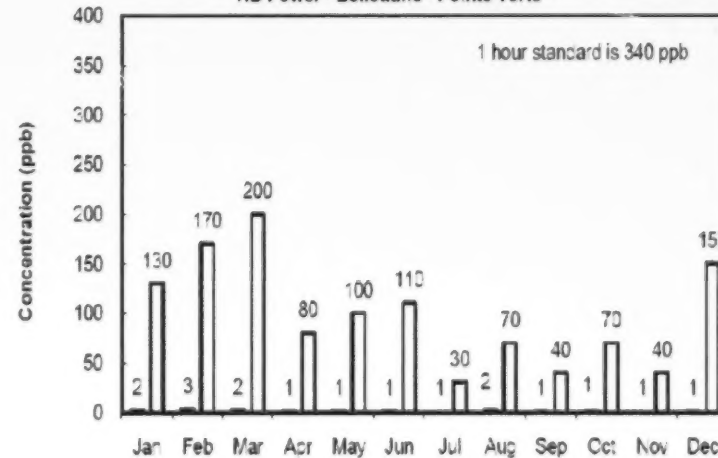
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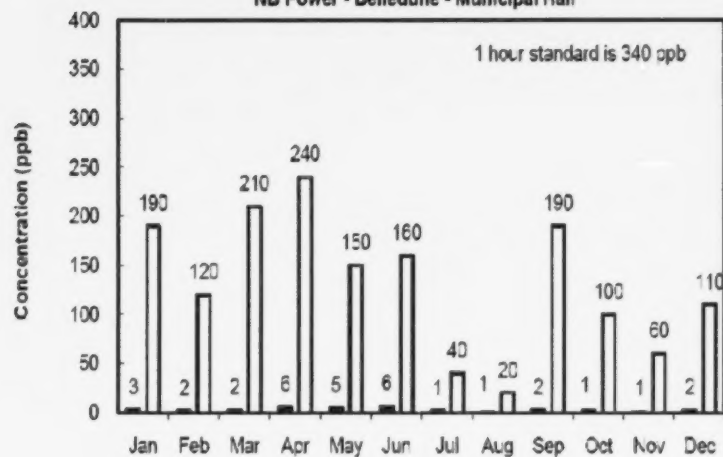


Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008

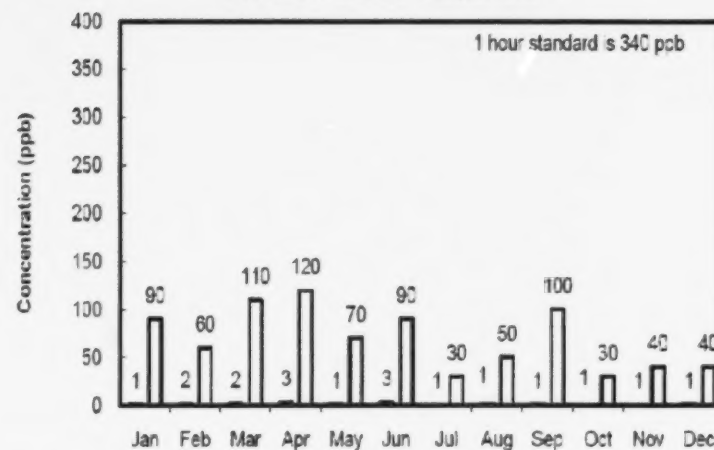
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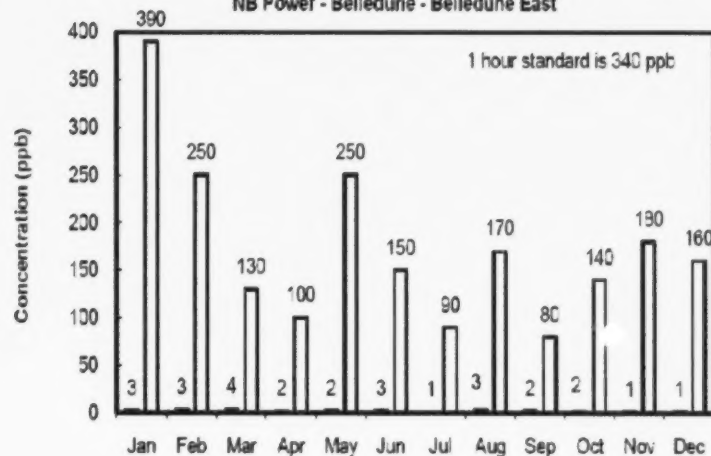
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power - Belledune - Municipal Hall



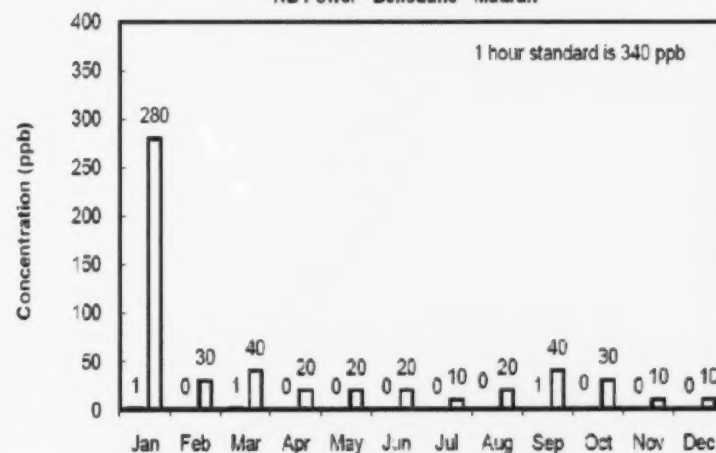
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power - Belledune - Jacquet River



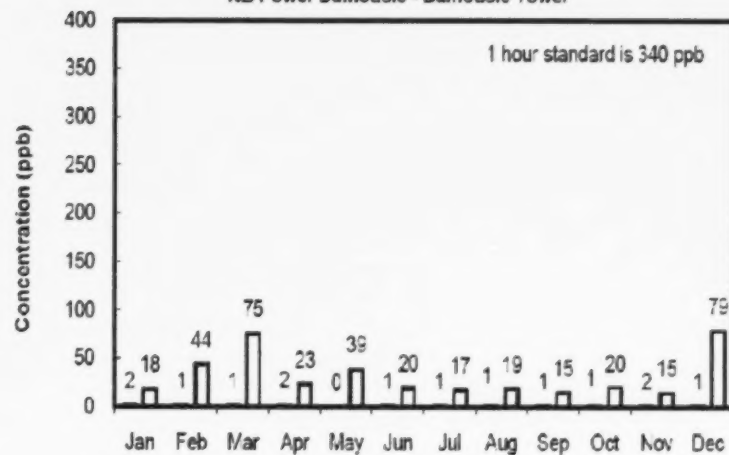
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power - Belledune - Belledune East



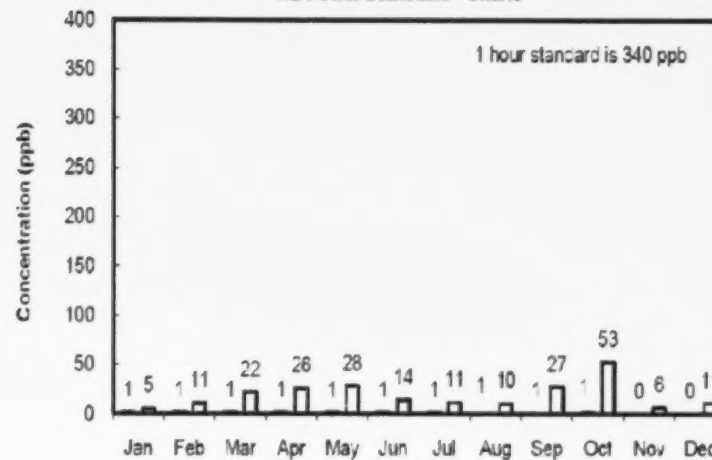
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power - Belledune - Madran



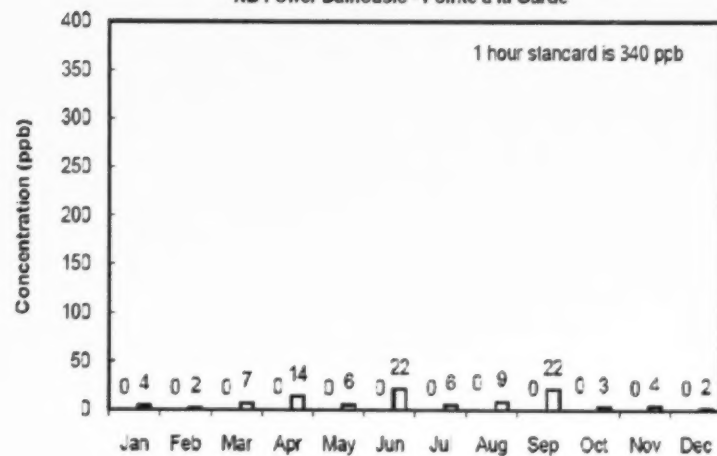
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Dalhousie - Dalhousie Tower



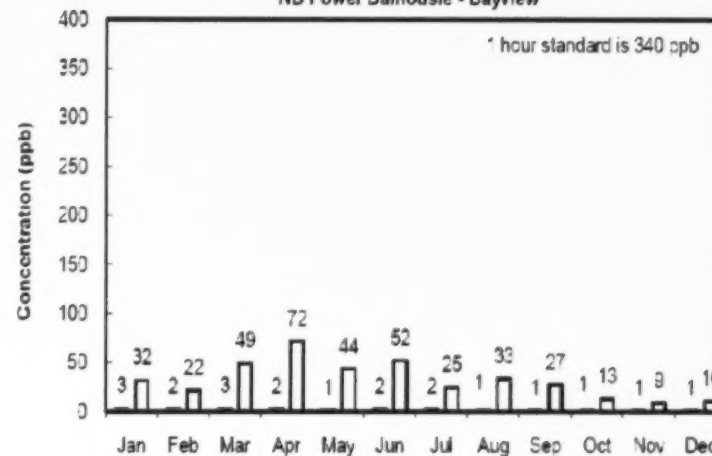
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Dalhousie - Charlo



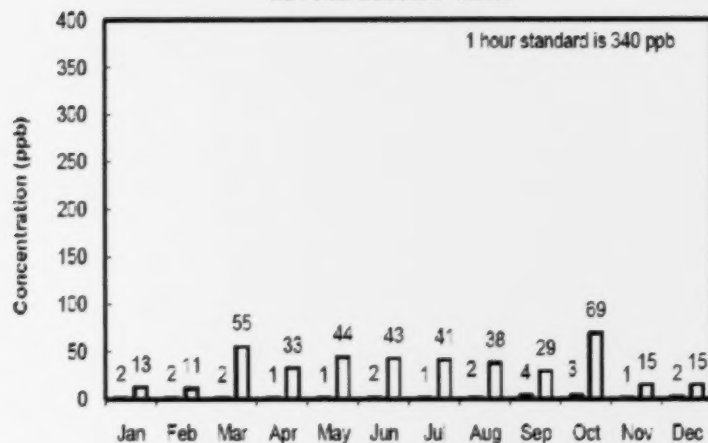
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Dalhousie - Pointe à la Garde



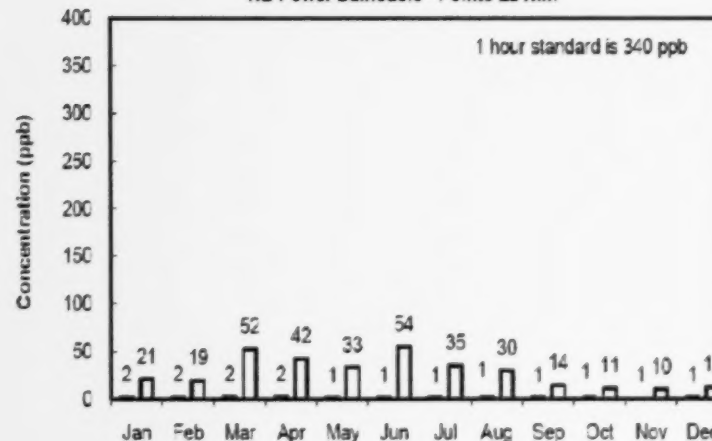
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Dalhousie - Bayview



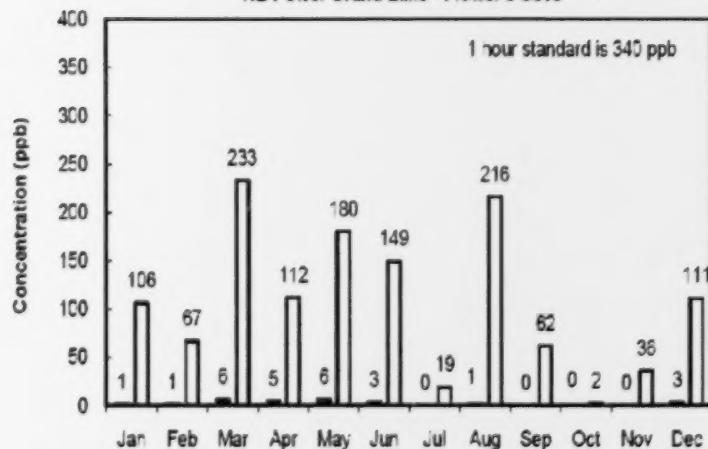
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Dalhousie - Mobile



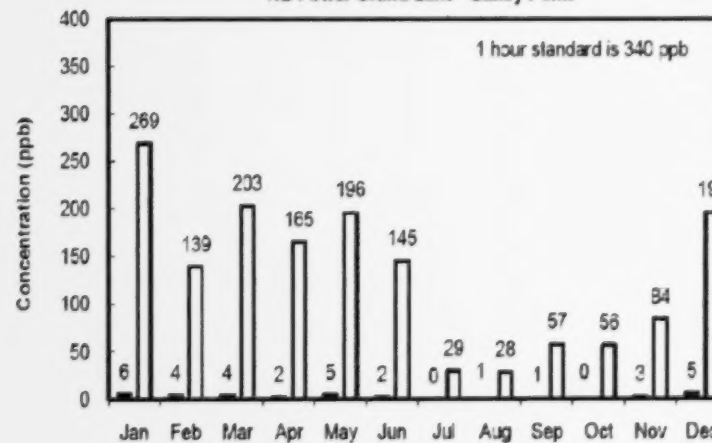
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Dalhousie - Pointe La Nim



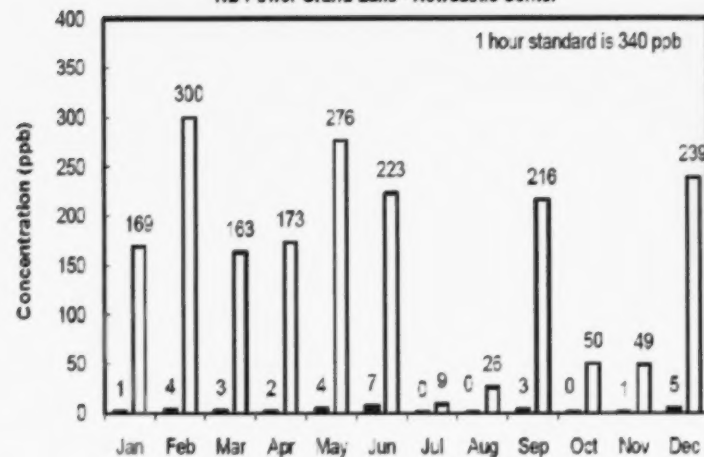
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Grand Lake - Flower's Cove



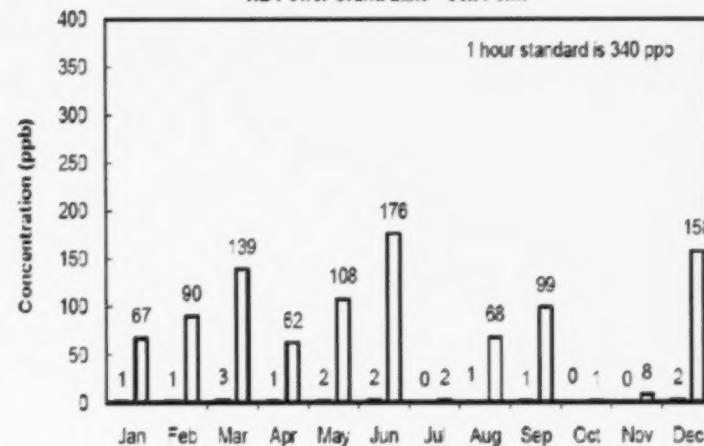
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Grand Lake - Bailey Point



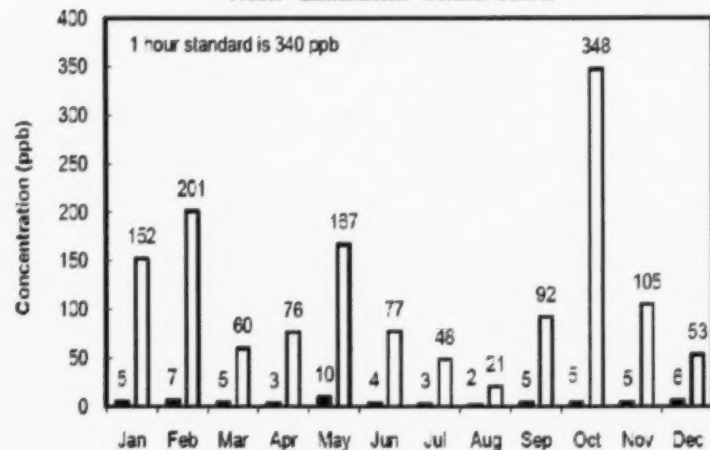
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Grand Lake - Newcastle Center



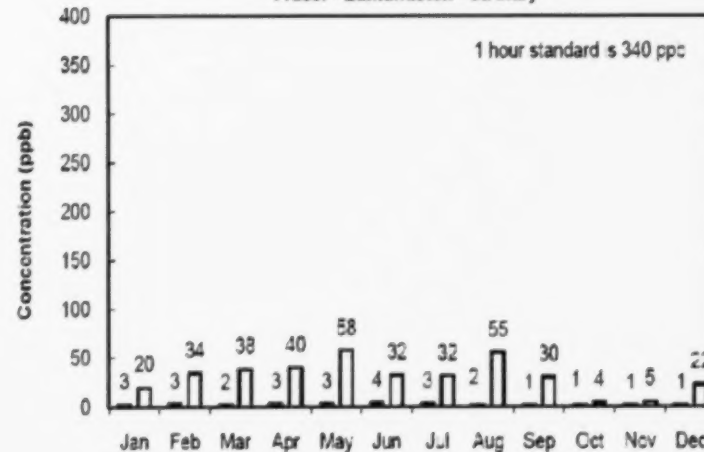
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
NB Power Grand Lake - Cox Point

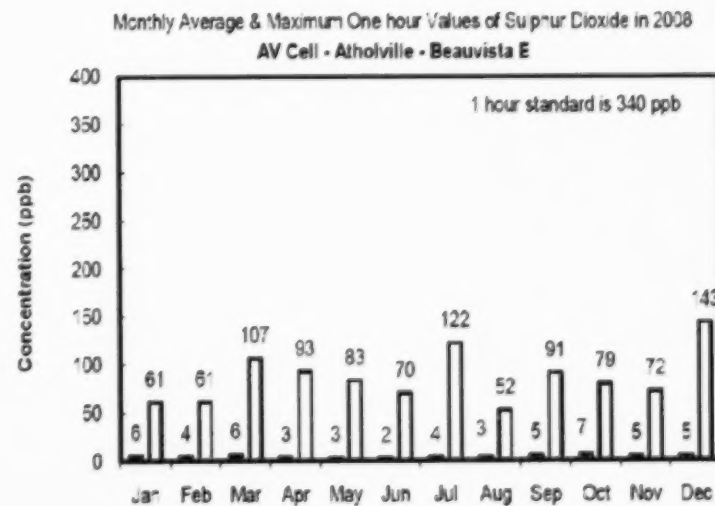
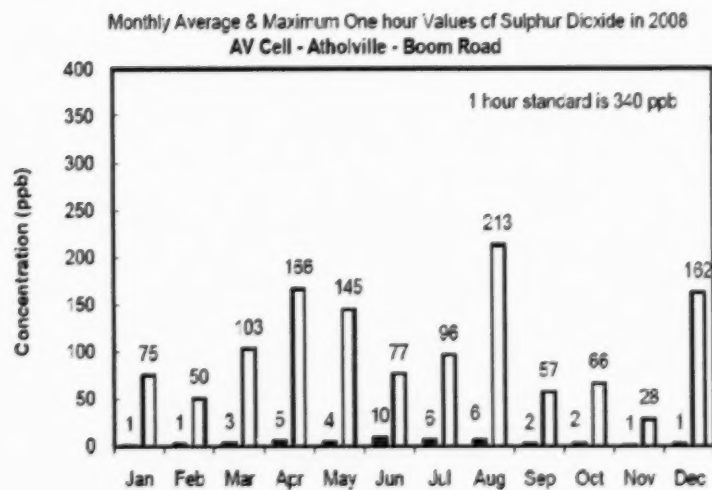
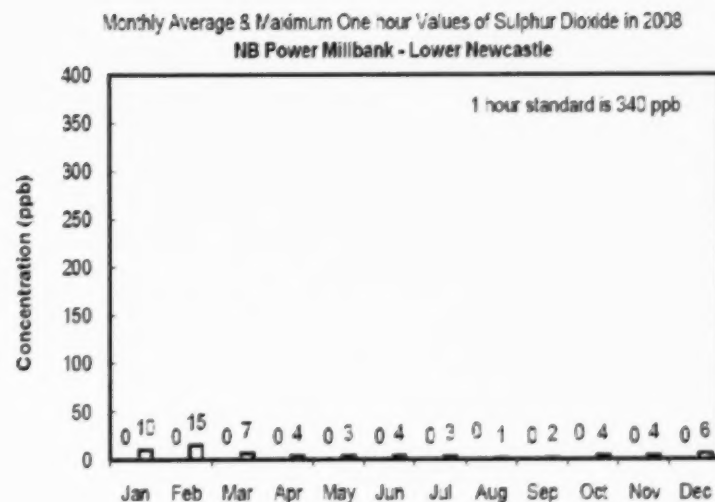
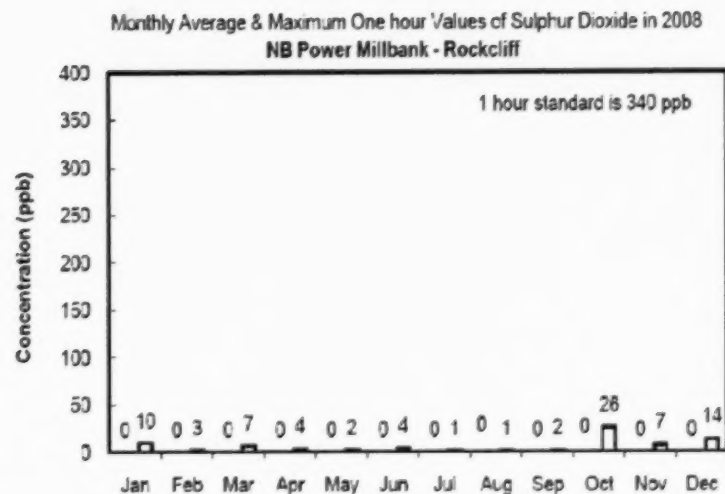


Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
Fraser - Edmundston - Cormier School

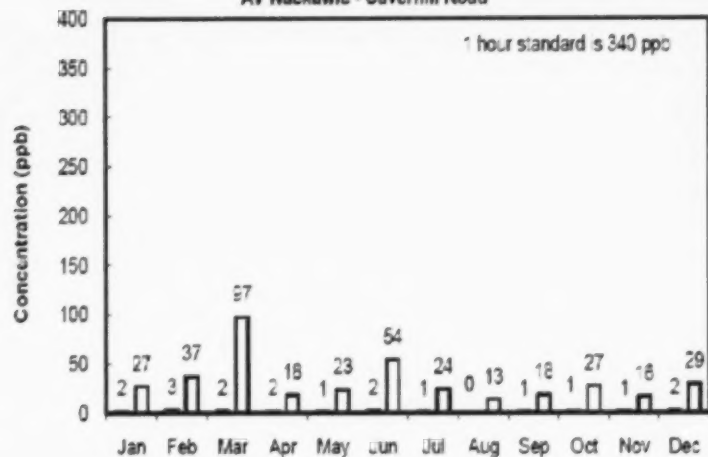


Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
Fraser - Edmundston - St. Mary

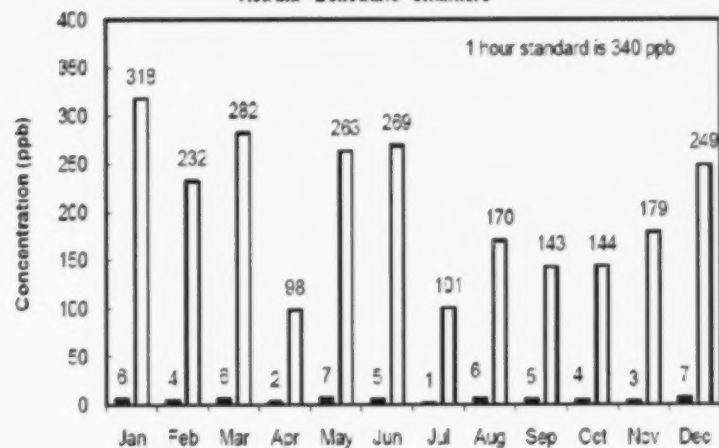




Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
AV Nackawic - Caverhill Road



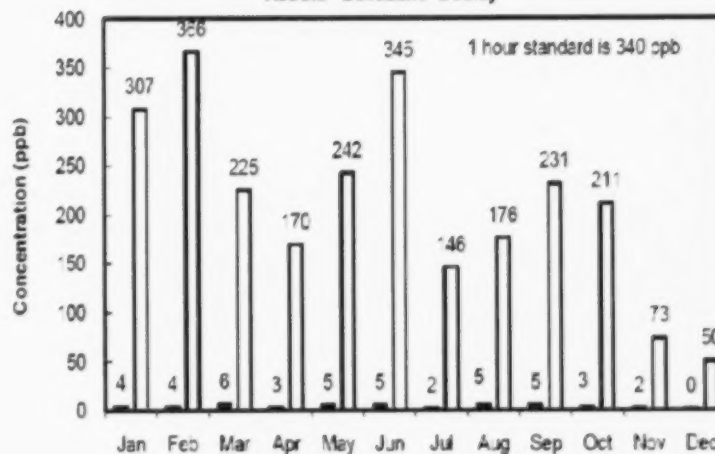
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
Xstrata - Belledune- Chalmers



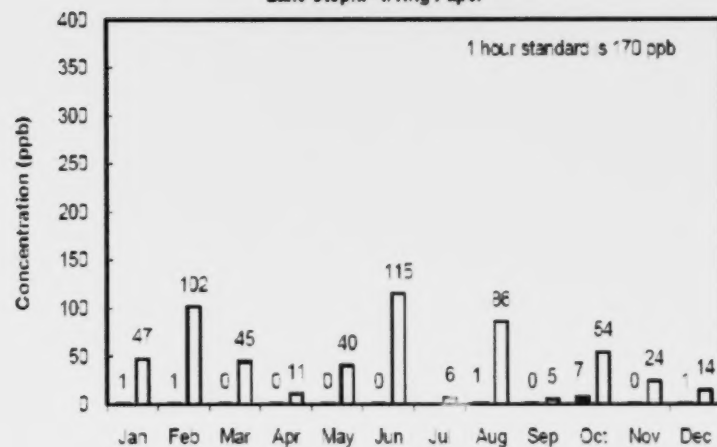
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
Xstrata - Belledune- Townsite



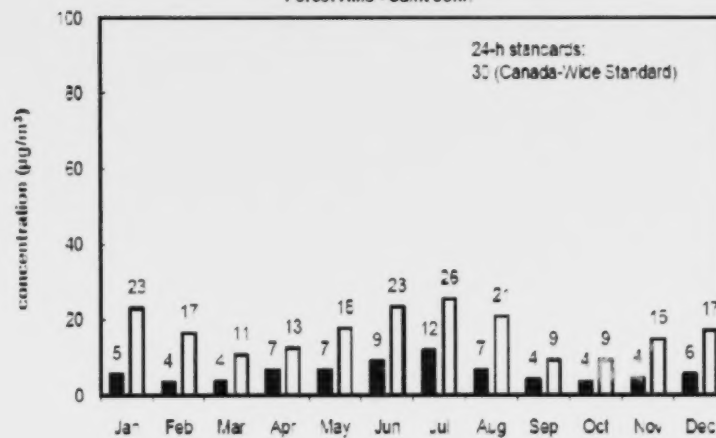
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
Xstrata - Belledune- Boulay



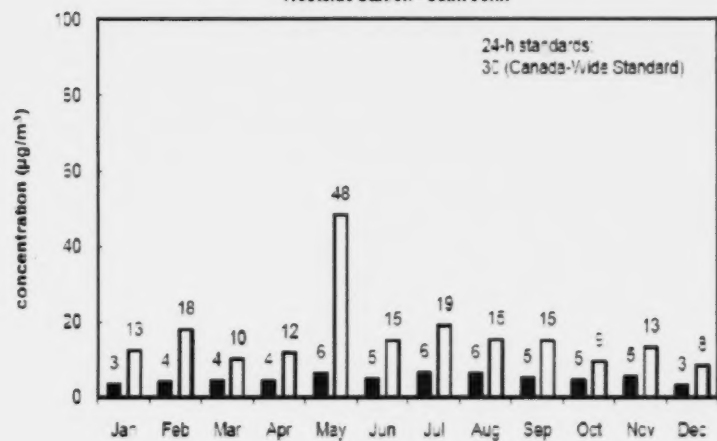
Monthly Average & Maximum One hour Values of Sulphur Dioxide in 2008
Lake Utopia - Irving Paper



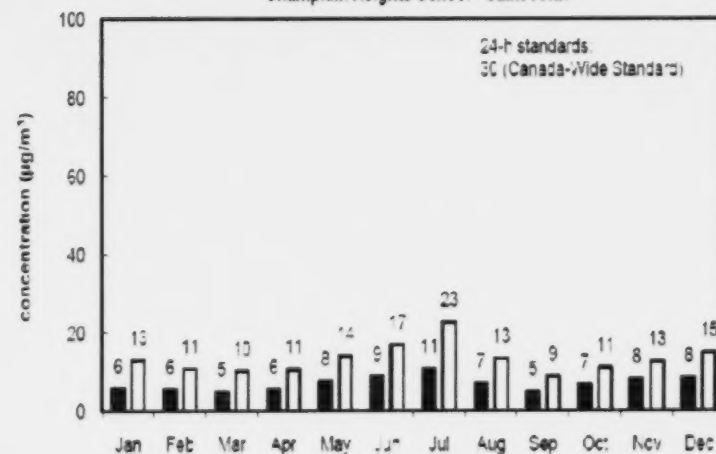
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
Forest Hills - Saint John



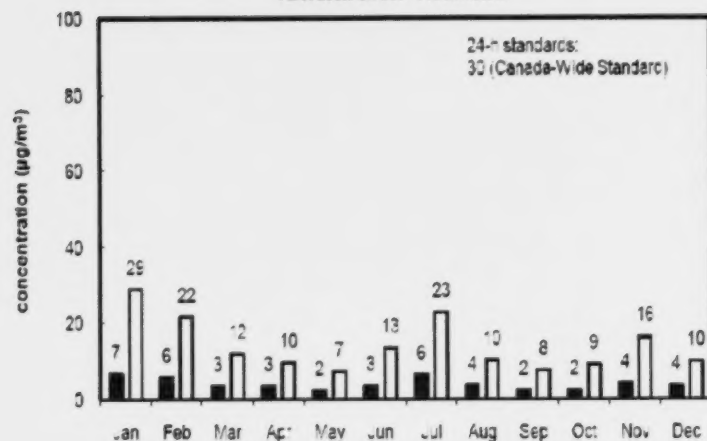
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
Westside Station - Saint John



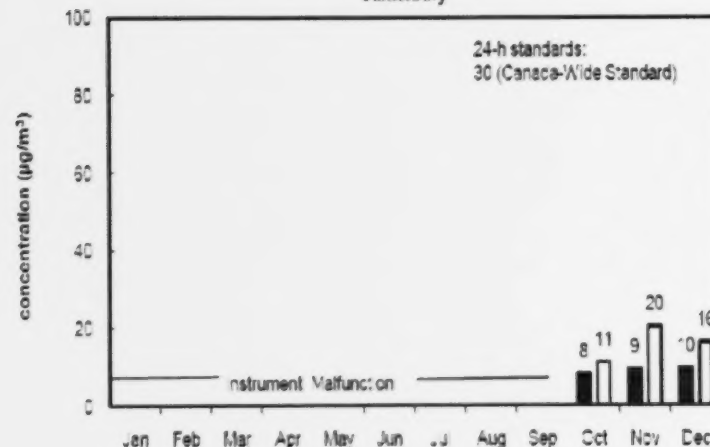
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
Champlain Heights School - Saint John



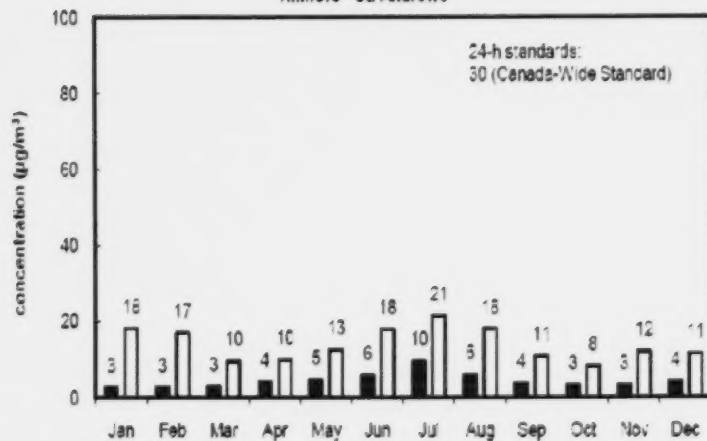
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
Aberdeen Street - Fredericton



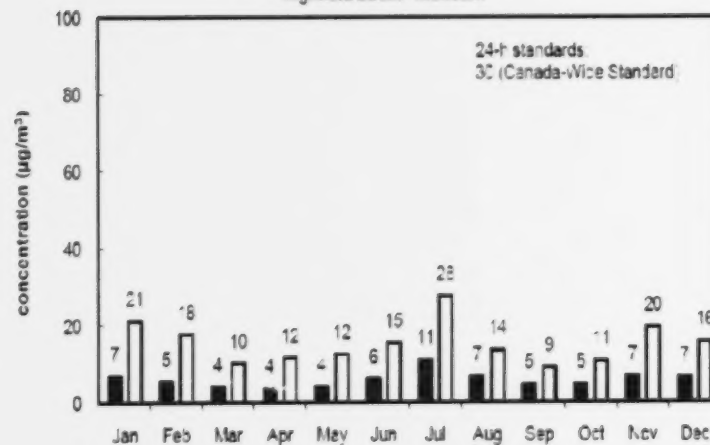
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
Canterbury



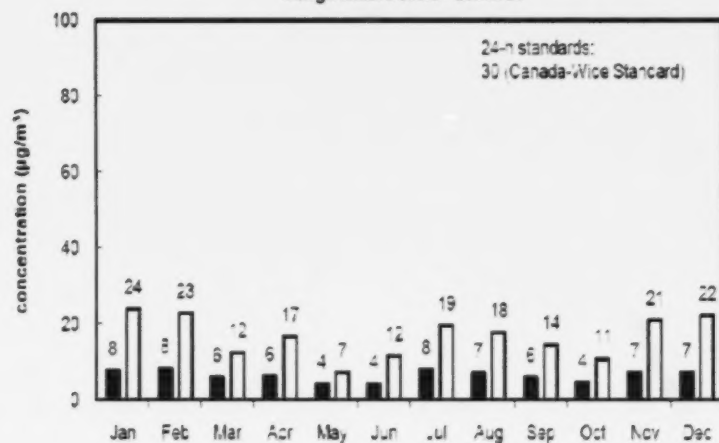
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
H.M.S.C - St. Andrews



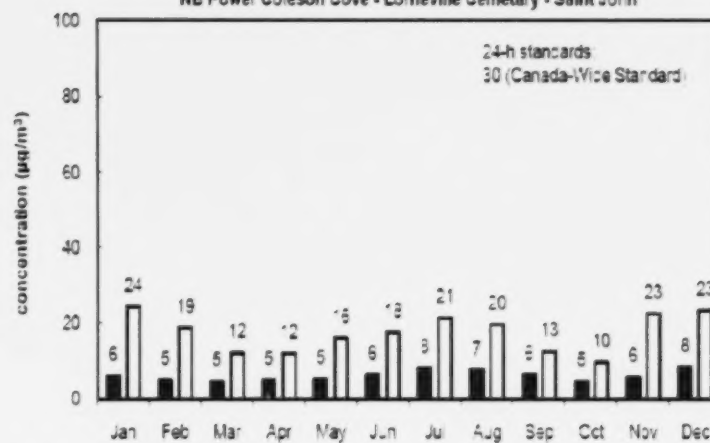
Monthly Average and Maximum 24-hour Values of PM_{2.5} for 2008
Highfield Street - Moncton



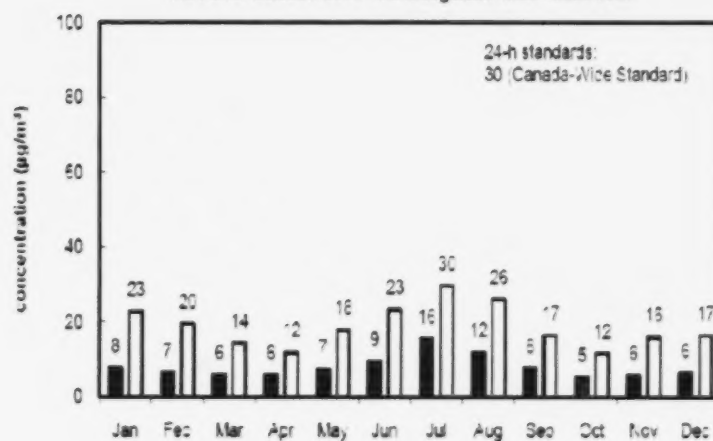
Monthly Average and Maximum 24-hour Values of $PM_{2.5}$ for 2008
Rough Waters Drive - Bathurst



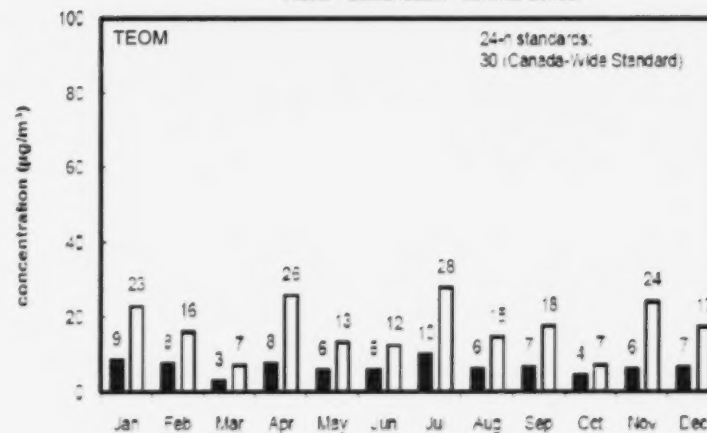
Monthly Average and Maximum 24-hour Values of $PM_{2.5}$ for 2008
NB Power Coleson Cove - Lorneville Cemetery - Saint John

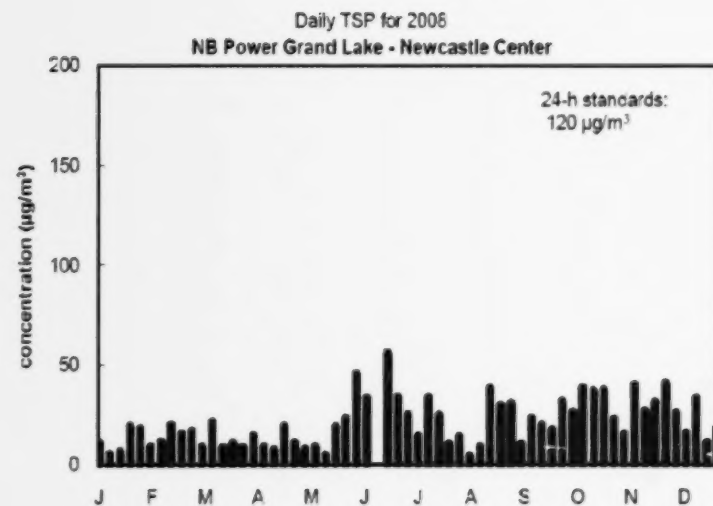
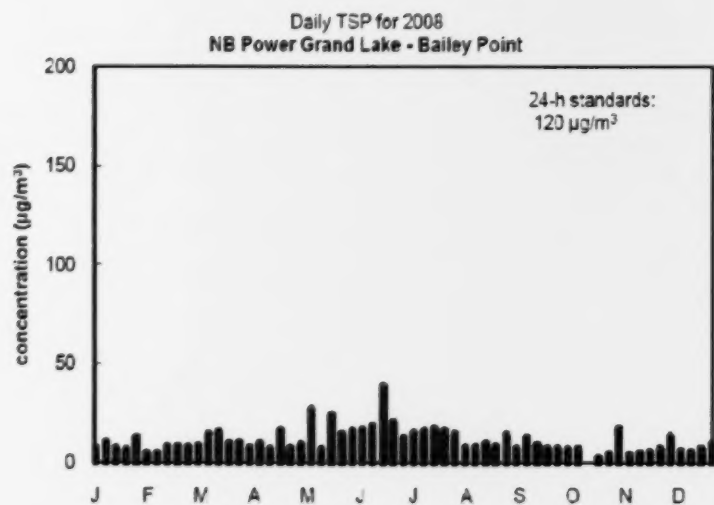
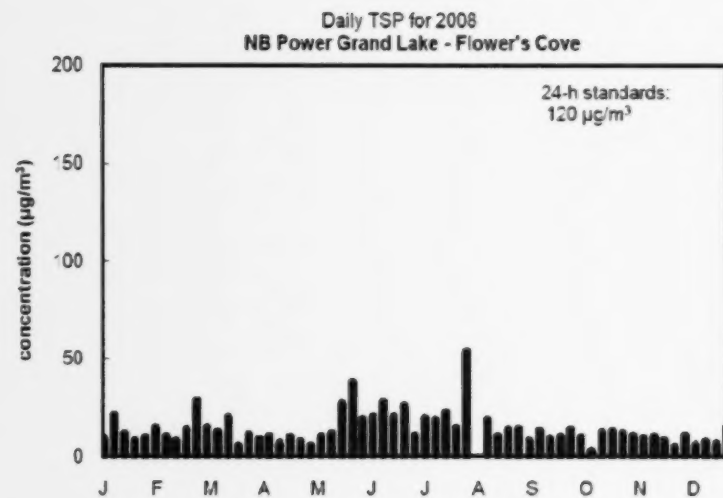
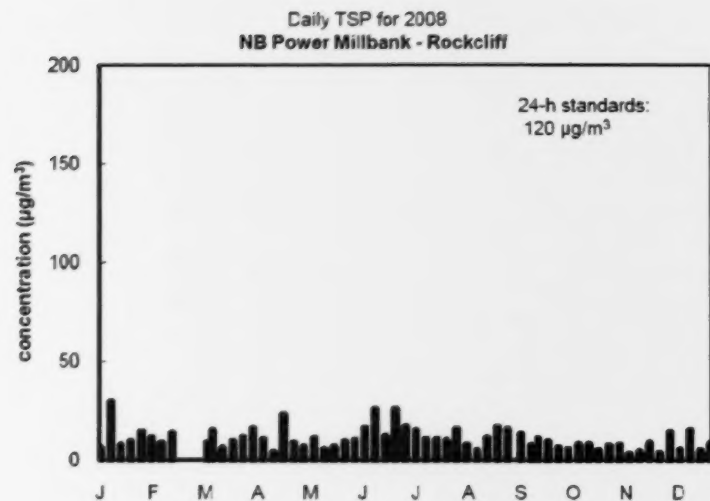


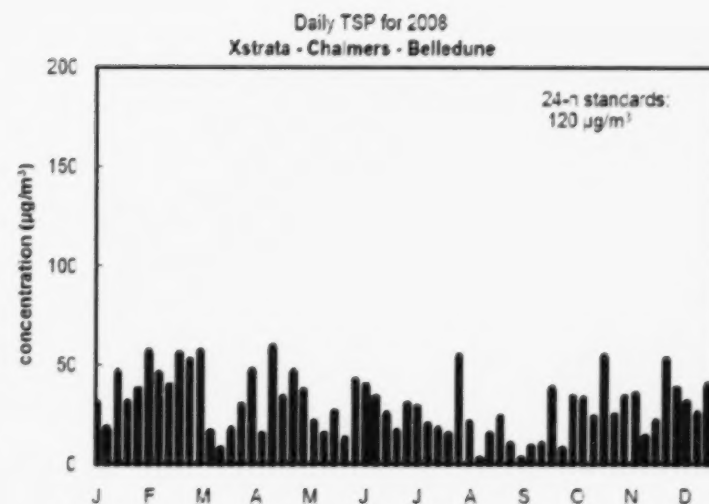
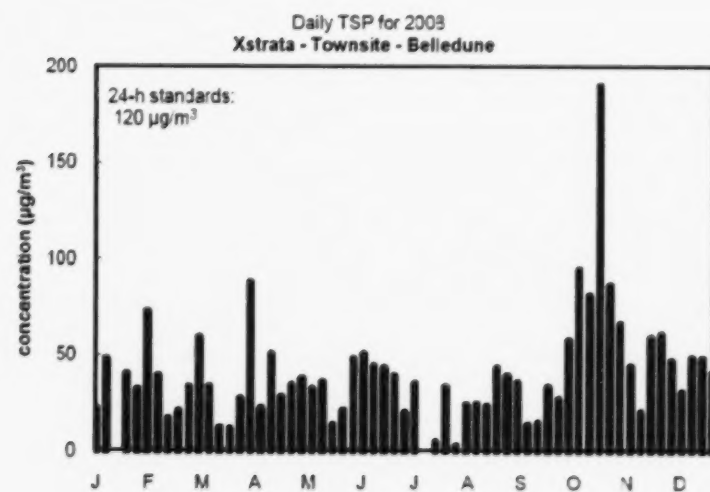
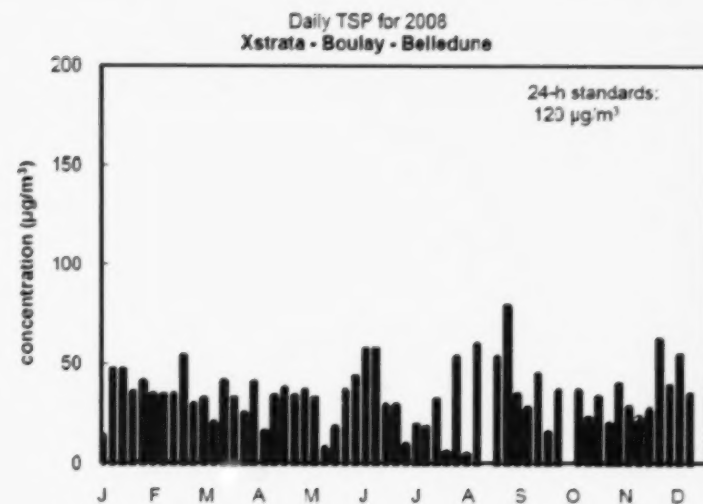
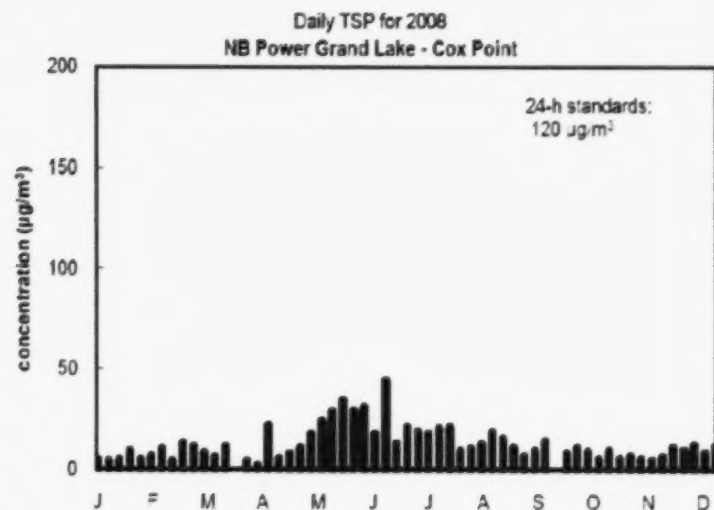
Monthly Average and Maximum 24-hour Values of $PM_{2.5}$ for 2008
NB Power Coleson Cove - Manawagonish Road - Saint John

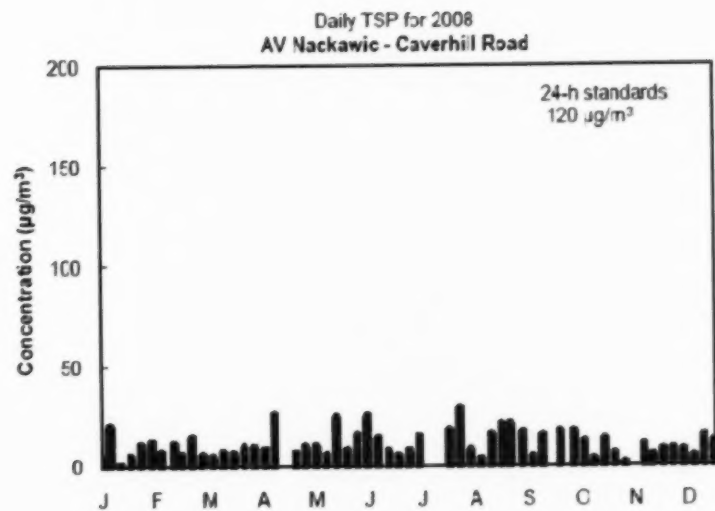
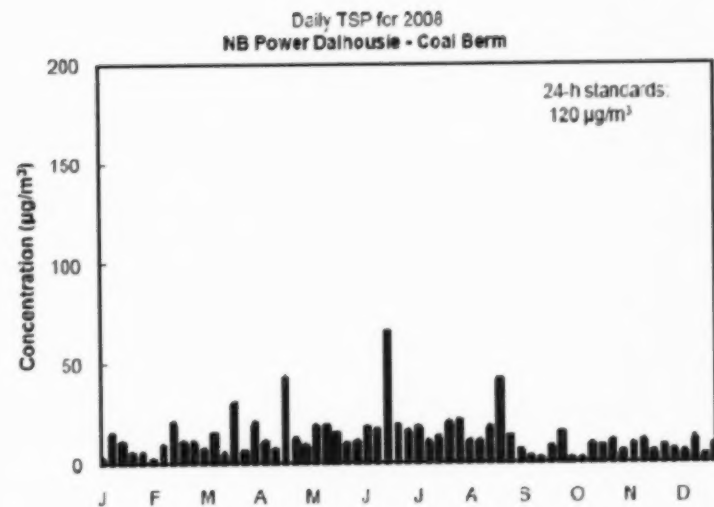
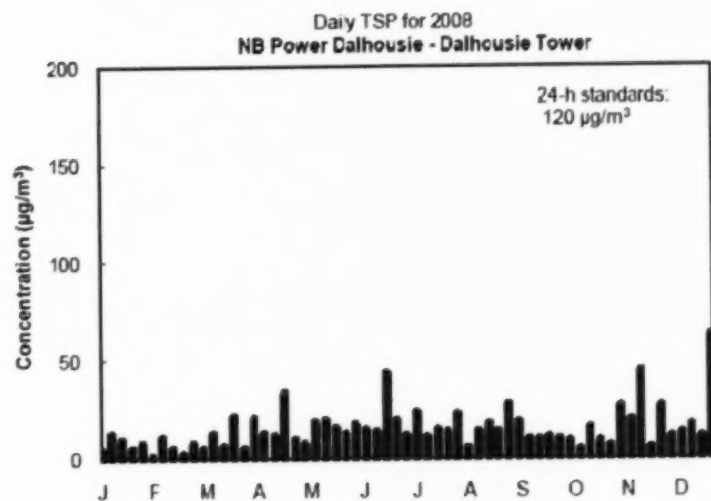


Monthly Average and Maximum 24-hour Values of $PM_{2.5}$ for 2008
Fraser - Edmundston - Cormier School









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